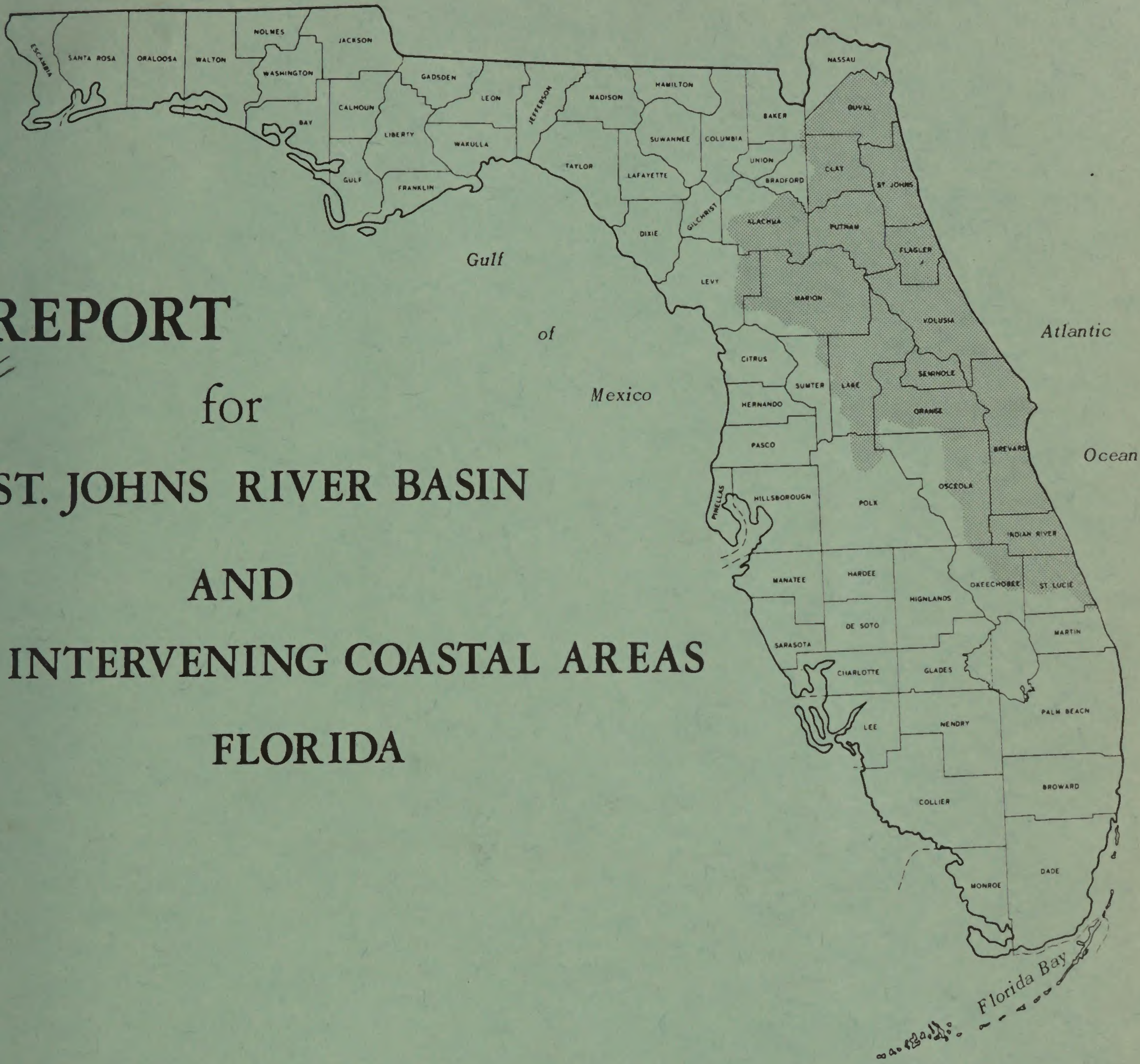

REPORT

for

ST. JOHNS RIVER BASIN

AND

INTERVENING COASTAL AREAS

FLORIDA

PREPARED BY
U. S. Department of Agriculture
U.S.D.A.

4-27979 4-69

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA

USDA-SCS-FORT WORTH, TEX. 1969

R E P O R T

ST. JOHNS RIVER BASIN
and
INTERVENING COASTAL AREAS

U. S. DEPARTMENT OF AGRICULTURE

RIVER BASIN INVESTIGATION

United States Department of Agriculture
In Cooperation With
The Division of Water Resources and Conservation
Florida State Board of Conservation

1969

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ADDENDUM

A recent reorganization was made of the Florida State Government, resulting in changes of various agencies. The "Florida Board of Conservation" as referred to in the report is now the Department of Natural Resources. The Division of Water Resources and Conservation is now the Bureau of Water Resources within the Division of Interior Resources.

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

Use and Development of Land and Water Resources for Agriculture

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ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

Use and Development of Land and Water Resources for Agriculture

INTRODUCTION

The Florida State Board of Conservation is making an inventory of the State's land and water resources in order to obtain information and data for use in administering and planning the physical aspects of development, management and use of these resources.

The inventory is being made by major drainage basins, or river basin groups. The data collected will be developed into a comprehensive report for each basin or group of basins, which will be used as the basis for developing a master plan for the conservation, utilization and management of the land and water resources of the entire State.

The Director of the Florida Board of Conservation requested the assistance of the United States Department of Agriculture in making investigations and preparing a summary report of the agricultural phases of the water and related land resources of the St. Johns Basin and Intervening Coastal Areas. The Director is authorized to request and participate in such a program by the State Government of Florida. The U. S. Department of Agriculture is authorized to cooperate under Section VI of Public Law 566 (River Basin planning section of Small Watersheds Act).

This report is concerned with the use and development of the soil and water resources of the St. Johns River Basin and Intervening Coastal Areas. It is the second report in a series of five, the first being the Southwest Florida area which covered the Florida West Coast Tributaries. Other cooperating Federal and State agencies listed below are furnishing reports to the Director of the Florida Board of Conservation relative to their interest and responsibilities. The information contained in each agency's report will be incorporated into a comprehensive report by the Water Resources and Conservation Division of the Florida State Board of Conservation.

Information contained in the U.S.D.A. report should be useful to individuals, groups, and governmental agencies involved in planning and implementing programs that will bring about optimum use of the land and water resources. The report also includes recommendations of projects and programs involving agricultural and upstream areas which would contribute to a comprehensive plan for resource development.

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This study was undertaken as a cooperative effort among State and Federal agencies having responsibilities in the field of land and water resource use and management. The assembly of data and the preparation of the USDA portion of the Report was under the leadership of the U. S. Soil Conservation Service in cooperation with the Economic Research Service and the U. S. Forest Service.

The Director of the Water Resources and Conservation Division, has the responsibility for coordinating the efforts of all agencies contributing to the study. Included among these, in addition to U.S.D.A., are U. S. Geological Survey, U. S. Army Corps of Engineers, Central and Southern Florida Flood Control District, Environmental Science Services Administration, Florida State Board of Health, Florida Forest Service, Florida Game and Fresh Water Fish Commission, Florida Outdoor Recreational Development Council, and the Florida Board of Parks and Historical Memorials.

Acknowledgement is made of the fine cooperation received from the Florida Agricultural Extension Service, Florida Agricultural Experiment Stations, Soil and Water Conservation Districts, Agricultural Stabilization and Conservation Service, Farmers Home Administration, county commissions, county and city planning organizations, East Central Florida Regional Planning Council, Southeastern Forest Experiment Station, and other agencies, organizations and individuals who have aided in the collection and development of data used in this report.

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S U M M A R Y

The primary objective of the survey is to facilitate the coordinated and orderly conservation, development, utilization and management of the water and related land resources of the Basin. Due consideration is given to projected land and water resource needs and use by an expanding population, and to the physical and economic aspects of flood prevention and control, watershed protection, drainage, irrigation, surface and subsurface water supply, water quality control, fish and wildlife, recreation and other related matters. Projections of needs and use of the land and water resources of the Basin are presented in two major settings. (1) Immediate Needs, a time frame for the next 10 to 15 years, and (2) Future Needs, a longer projection period to the year 2020.

The St. Johns River Basin and Intervening Coastal Areas includes an area of 11,431 square miles or 7,316,000[1] acres of land and water. There are 432 square miles of fresh water streams and lakes and 653 square miles of salt or brackish water streams and estuaries. Agricultural and forestry enterprises occupy 9,228 square miles of land. Non-agricultural land uses, including urban, industrial, rights-of-way, airports, golf courses and other similar uses occupy 1,118 square miles. Located in the Basin is the Ocala National Forest, an area of approximately 361,400 acres, established in 1908 and administered by the Forest Service, U.S.D.A. This Forest is managed under the Multiple Use - Sustained Yield Act of June 12, 1960 for outdoor recreation, range, timber, watershed protection, and wildlife and fish purposes.

Economic development within the Basin following World War II has been much more rapid than that experienced nationally. This is evident from the expansion of employment opportunities and personal income. The Basin's annual growth rate between 1950 and 1965 was 7 percent compared to only 2 percent nationally. During this 15-year period, population doubled, reaching about 1.5 million while national population was increasing 27 percent.

The agricultural and forestry enterprises of the Basin include approximately 357,000 acres of citrus, 69,000 acres of vegetables, 108,000 acres of other crops (general field crops, hay and seed crops, nuts, fruit crops other than citrus, ferns and ornamentals), 635,000 acres of improved pasture, 707,000 acres of range or unimproved pasture, 3,515,000 acres of forestland, and 516,000 acres of miscellaneous agricultural uses (including rural homesites, idle land and open wildlife areas). More than one-fourth of the Nation's citrus products are grown within the Basin.

1/ Summary figures are rounded to the nearest 1000 acres.

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In 1965, 529,400 acre feet of water was used for agricultural purposes. The daily use for rural household, livestock, rural lawns and gardens, water for spray operations, and golf courses was 98.8 million gallons or about 110,700 acre-feet per year. Of the total 418,700 acre-feet of water used for irrigation, 84 percent (353,300 acre-feet), came from underground sources, with the remaining 65,400 acre-feet coming from surface supplies.

Water of suitable quality is inadequate for both agricultural and non-agricultural purposes in certain areas of the Basin, especially in counties bordering the coast. An estimated one third of the Basin's citrus is endangered by a lack of good quality irrigation water. This quality deficiency is generally due to high mineralization of the ground water and the influence of highly mineralized spring flow as well as tidal action on surface streams near the coast. The water in the St. Johns River north of Lake Harney to the mouth of the river is generally unsuited for irrigation, due to excessive chloride content.

Excess water is a major limitation in the development of much of the land resources, affecting 4,250,000 acres or 72 percent of the agricultural land in 1965. Treatment measures had been applied on 250,000 acres. Projections indicate that by 1980, there will be 5,548,000 acres of land available for agriculture, of which 3,994,000 acres will have excess water hazards. By 2020, the base will be 4,970,000 acres, with an estimated 3,638,000 acres subject to these hazards. Based on present trends in establishing works of improvement through existing programs, and projects evaluated as being feasible under projected future needs, it is estimated that 27 percent of the land in agricultural uses will be treated to reduce excess water hazards. The percentages of soils by land uses treated in 1965, and projected to be treated are:

	In 1965	By 2020
	(Percent)	
Citrus	38.6	72.3
Other Crops	50.1	69.7
Improved Pasture	17.8	61.6
Forestland	2.7	7.8

Projections to meet immediate and future land and water resource needs were based on a logical pattern of future changes in land and water use. These changes include substantial intensifications in use of land and water resources. There will be urban growth, expanded production of citrus and vegetables, and an increased agricultural orientation toward the need for milk, eggs, poultry, beef, and greenhouse and nursery products.

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Projections for future use (by 2020) indicate that the fresh water area will increase by 225 square miles. The land area devoted to agriculture will decrease by 1462 square miles, while the non-agricultural area will increase by 1,038 square miles and reserve areas will increase by 199 square miles.

The 4,970,000 acres of land projected to be available for agricultural use by 2020 include 546,000 acres of citrus, 97,000 acres of vegetables, 129,000 acres of other crops, 1,084,000 acres of improved pasture, 70,000 acres of native rangeland, 2,773,000 acres of forestland, and 271,000 acres of miscellaneous agricultural uses.

With the development of water and related land resources, value of agricultural and forest production will rise. In 1965, production income from agriculture was an estimated $257 million, while forestland owners received $6.5 million in payment for forest products. By 1980, the value of production is expected to reach about $380 million with stumpage value increasing to approximately $7.2 million. Basin agricultural production should approach a value of $600 million with stumpage values of harvested wood products reaching about $17 million by 2020.

Major cash inputs of agriculture in the Basin in 1965 were $130 million. Cash inputs are projected to increase to $230 million annually by 1980, and to $500 million by 2020. In reaching the projected level of production of wood products, it is estimated that an average of $1.3 million annually will be spent for forest protection, management and land treatment.

The total agricultural land area is expected to decrease by more than 900,000 acres by 2020. This reduction in land available for agriculture, along with the hazards and limitations associated with the use of the soil resources points up the necessity for resource development.

Flood prevention and agricultural water management works of improvement evaluated in terms of immediate needs indicate that 30 planning units are feasible, 2 of which have Public Law 566 Work Plans but would require modifications to fit into and complete the water management proposals for the Upper St. Johns Area. Seven were considered marginal and 27 not feasible. Total installation cost for the 30 units would be $66 million with an annual cost of $4.1 million. Benefits from works of improvement for these units would amount to $7.6 million annually on 430,000 acres of citrus, other cropland, improved pasture and forestland.

Six planning units which were found to be marginal or unfeasible in the immediate time period, will have a favorable benefit-to-cost ratio when evaluated under future conditions, due to intensification in land use. The total installation cost for these six units is estimated to be $7.9 million with an annual cost of $0.4 million. Annual benefits are estimated to be $1.1 million.

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The works of improvement generally consist of systems of channels with associated grade stabilization and water management structures to provide drainage, flood protection and water conservation.

By 2020 agricultural water use will be approximately three times the amount used in 1965 or 1,422,000 acre-feet per year. Daily water use for rural households, livestock, rural lawns and gardens, spraying, and golf courses will amount to 241 million gallons per day or about 270,000 acre-feet per year. Water needed for irrigation will amount to approximately 1,152,000 acre-feet annually. It is estimated that existing and proposed surface supplies could provide about 480,000 acre-feet with the remainder, to the extent available, coming from underground sources.

Development of fresh water storage reservoirs is limited by the Basin's topography. A few potential sites could be developed on fresh water streams and on natural lakes in the northern reaches of the Basin. Their use would be for recreation, fish, and wildlife. In the south, impoundments would consist mainly of closed levees with pumps for backpumping storm runoff water for conservation storage behind the levees. Impoundments proposed in this report - in Planning Units 76 and 78 and the Upper St. Johns area - could provide approximately 445,000 acre-feet of surface water storage for irrigation.

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CONCLUSIONS AND RECOMMENDATIONS

Need for Comprehensive Planning

Agriculture concurrently faces problems of relocation and expansion to satisfy product needs in an environment of growing competition for resource use. It is anticipated that land used for agriculture will decrease from 5,905,600 acres in 1965 to 4,970,000 acres by 2020. At the same time, needs for products from the Basin are projected to increase by 275 percent for citrus, 198 percent for vegetables, melons and potatoes, 330 percent for livestock and poultry, and 164 percent for wood products. It is recommended that comprehensive and coordinated planning be participated in by all interests and at all levels, in order that the requirements of agricultural, industrial, and urban land and water resource users might best be fulfilled.

Need for an Increase in the Rate of Installation of Works of Improvement for Management of Excess Water

The availability of sufficient land to meet the level of production required to supply the Basin's projected share of agricultural commodities will be dependent upon accelerated land and water development. The current rate of research and technological development will not satisfy the future level of needs. Projected land needs will involve many areas having excess water problems. Disposal of excess water will tend to greatly overtax present waterways and water control developments, thereby increasing the need for improved individual and project-type water control systems.

The inventory of soils in agricultural uses in 1965, including forestry, revealed that 72 percent have excess water hazards, with 5.9 percent adequately treated. The projected future agricultural use indicates that 73 percent of the soils will have these same hazards. It is recommended that works of improvement for the management of excess water be accelerated on a coordinated Basin-wide basis, making full use of assistance available for flood control, flood prevention and watershed protection, land drainage and related programs.

Need for the Development of All Economically Feasible Sites for Storage of Fresh Water

The projected need for fresh water by both agricultural and non-agricultural interests, including recreational uses, makes it imperative that all available impoundment sites - natural and artificial - be developed. Even with such development, sub-surface water will continue

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to be the major source of fresh water supply. Commercial truck crops, most of which were irrigated in 1965, are expected to be entirely under irrigation in the future. Irrigated pasture is expected to increase from about 5 percent of the total improved pasture in 1965 to 20 percent by 2020. It is estimated that 84 percent of the total citrus acreage in 2020 will be irrigated. Projections indicate a 136 percent increase in water needs for rural domestic uses, livestock and golf courses. Information on water needs for non-agricultural purposes is being developed by the Florida State Board of Conservation for inclusion in the State's report for the Basin. It is recommended that provisions be made to impound as much of the storm runoff for later use as possible.

Need for Measures Promoting the Replacement of Ground-Water Resources

Known areas of significant groundwater recharge should be dedicated to this use and protected from developments that would tend to decrease infiltration rates or prevent water from percolating into underground storage areas. More research is needed to determine sources of sustained groundwater yields for specific locations.

Full and immediate consideration should be given to the feasibility of employing drainage wells to induce excess surface water into the underground aquifers, particularly in those locations where heavy withdrawal rates by urban and industrial users have created deep cones of depression in the piezometric levels.

The United States Geological Survey Report "Water Resources of Northeast Florida, 1968", states that about 5.6 inches of annual rainfall percolates into the aquifers, with more than half of this emerging as springs to augment surface streamflow. The 1965 River Basin inventory of water used for irrigation, rural domestic, livestock and golf courses showed that 0.76 inches of groundwater was withdrawn. The projected need from this source by the year 2020 would amount to 1.55 inches for these same purposes.

Need for Greater Productivity and Use of Forestland

Supplying future needs for forest products from a reduced acreage of forestland is dependent upon the employment of measures that will increase the production of fiber by nearly 3 times. This will require a 20 percent increase in the number of seedlings planted and improving forest management practices on more than half of the forestland with special emphasis on increasing growth on low-producing areas. The forestland acreage is expected to decrease

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at the rate of about 17,000 acres per year until 1980, after which the decrease will average approximately 12,000 acres per year until 2020. Early action to increase the production of forest products is necessary to offset the losses of forestland to other uses. Meeting the immediate demands for forest products will require an increase in the average growth per acre from 21 cubic feet annually in 1965 to 28 cubic feet by 1980. To meet future demands, an average annual growth per acre of 77 cubic feet will be needed.

Maximum use of the forestland will require a combination of uses to meet the needs of an increasing population. The conflicts between uses should be reconciled to serve the greatest number of people. The forest cover resulting from more intensive management will afford watershed protection, opportunities for recreation, wildlife, and hunting, and enhance the scenic beauty of the environment.

It is recommended that: (1) the present level of cooperative forest fire protection now in effect on the forestland be extended to include about 248,000 additional acres; (2) urban planners consider the value of trees to furnish shade and areas of forestland for noise abatement and esthetics, infiltration zones and park development in and adjacent to residential and industrial sites; (3) forest areas be preserved or developed where needed for rest areas along highways; (4) research be continued to obtain more information on the effects of different degrees of water control on wet soils, and the resulting growth rate of pine; (5) forest management programs be intensified to meet the demands for wood.

The early action program calls for an acceleration of forestland treatment measures on 1,467,000 acres for improved harvesting methods; on 102,400 acres for regeneration of forest stands, and on 123,000 acres for timber stand improvement. (See Table 7.1).

<u>Need for Implementation of a Comprehensive Water Control System for the Upper St. Johns River and Intervening Coastal Area, the Palm Bay and the Spruce Creek Planning Units</u>

The Upper St. Johns Area of approximately 858 square miles is an area of critical water needs both in quantity and quality. Potential development and the continued use of existing developments depend on solutions to problems resulting from hazards and limitations in the use of land and water resources. This area represents 7.5 percent of the total Basin. Citrus and pasture comprised 21.5 and 10.6 percent respectively of the Basin's acreages in these uses in 1965.

To meet projected needs would require an increase in citrus acreage of 78 percent, pasture 100 percent and non-agricultural use 176 percent. An appraisal of the soil capabilities of the area indicates that agricultural crops and non-agricultural improvements would be subject to excess water damage, in varying degrees of severity, on 98 percent of the land. The inventoried irrigation water used in 1965 amounted to an annual withdrawal of 3.77 inches from the 858 square mile area. The potential needs would be 6.33 inches. The source of water supply is mainly ground water from the Floridan Aquifer. Generally, the upper part of the Floridan Aquifer in this area is highly mineralized with concentrations of chloride from 50 to more than 1000 parts per million and sulfate up to 250 parts per million. These concentrations tend to increase with increasing depths into the aquifer. It is recommended that a comprehensive and coordinated surface water control system to collect, store and dispose of excess runoff water be implemented at an early date. Such a system is proposed in the Watershed Investigation Report for the Upper St. Johns River, which is included in the Planning Unit Appendix to the Basin Report.

It is further recommended that steps be taken by local sponsoring agencies to arrange for the simultaneous authorization and subsequent planning as permitted in Section 2 of Public Law 566, of those sub-watersheds designated as Planning Units numbered 37 (Indian River County), 45, 46, 47, 79, 80, 81, and 82, delineated on Figure 7-3 of this report. Also recommended are Spruce Creek (Number 76) and Palm Bay (Number 78) planning units. These latter two units as well as the other units included in the early action program are expected to be implemented under the going P.L. 566 watershed program. Time would not permit the development of individual Watershed Investigation Reports for all units appearing to be feasible, which would likely become a part of an early action program. The investigation reports were made on enough planning units to present a representative sample of what might be expected in the form of project needs in the next 10 to 15 years, taking into account these and other feasible units evaluated on a less intensive type investigation.

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SECTION I

NATURAL RESOURCES OF THE BASIN

Description of the Basin

The St. Johns River Basin and Intervening Coastal Areas is located along the eastern seaboard of Florida, extending from Ft. Pierce on the south, to immediately north of Jacksonville on the north. The 11,431 square mile area is bounded by the watersheds of the Nassau and St. Marys rivers on the north, the Suwannee on the northwest, and the Waccasassa, Withlacoochee and Kissimmee rivers on the west. State Highway 68 forms the south boundary of the Basin, excluding that portion of the North St. Lucie Drainage District located north of Highway 68, and the entire eastern boundary is the Atlantic Ocean. The area is made up of 10,346 square miles of land and 1,085 square miles of surface water - 432 square miles being fresh water lakes and streams, and 653 square miles being salt water estuaries and rivers.

All, or parts of 19 counties are encompassed within the boundaries of the Basin. The four major sub-basins are Upper St. Johns River, Oklawaha River, Lower St. Johns River and the Intervening Coastal Areas. For watershed planning purposes these have been divided into 86 areas or planning units, as shown in Figure 1-1, ranging in size from 22 to 838 square miles.

Climate and Rainfall

The climate of the Basin varies from temperate in the north to subtropical in the central and southern parts with the 25-degree average annual minimum temperature line being the approximate divide between the two zones. This divide is also the approximate northern limit for citrus production. The average annual temperature is about 72 degrees. During the winter, the temperature is considerably colder in the north than in the subtropical south; while summer temperatures are relatively uniform throughout. Figure 1-2 shows the average temperature for various areas by months. Temperature ranges in the Basin have a great influence on agriculture, especially on citrus and winter vegetable production.

Average annual rainfall is approximately 53 inches (Figure 1-3) with over 50 percent falling during the four months of June, July, August and September. Precipitation is fairly uniform except for the southeastern part of the area which has a higher than average

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rainfall. Figure 1-4 illustrates the annual distribution pattern by months for various areas. The high summer rainfall and low winter rainfall are quite evident from this figure as is the similarity of the distribution pattern. Rainfall during the summer months is usually from thunderstorms while winter rains are normally associated with frontal type storms.

The Basin has had a lower incidence of hurricanes than any other area of its size in Florida. Almost all of the hurricanes that have hit the area since 1900 have crossed the State from the southwest before entering the Basin and therefore were considerably weaker than they would have been if they had entered over water from the east. Hurricane Dora in September 1964 was the first hurricane to enter the Basin from the East Coast since 1900 or earlier. According to Weather Bureau predictions[1/] the chance of hurricane force winds at Jacksonville in a given year is 1 in 50 while at Daytona Beach the chance is 1 in 30.

Growing Season

The average growing season, or period between the last killing frost in spring and the first in fall varies from about 285 days in the north to 330 days in the south. This difference is apparent when traveling from south to north by the changes in vegetation. It ranges from a sub-tropical type setting of palms, perennial flowering shrubs and ornamentals, citrus, and other subtropical fruits in the south to a predominance of oak and pine forests and general farming areas in the north. Improved pastures are located throughout the Basin, but the milder climate in the south is more favorable to certain varieties. Vegetables are grown throughout the Basin. With the exception of potatoes, cabbage and celery, most of the vegetables are grown in the southern part where the milder climate allows earlier planting. This results in the products reaching a higher priced market.

Physiography

Topography

The Basin consists of low, nearly level plains, gently undulating to rolling hills; numerous intermittent ponds, swamps and marshes; and many lakes and a few perennial streams. Elevations range from sea level along the coast to approximately 310 feet

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1/ Climates of the States - Florida, November 1962, U.S. Weather Bureau

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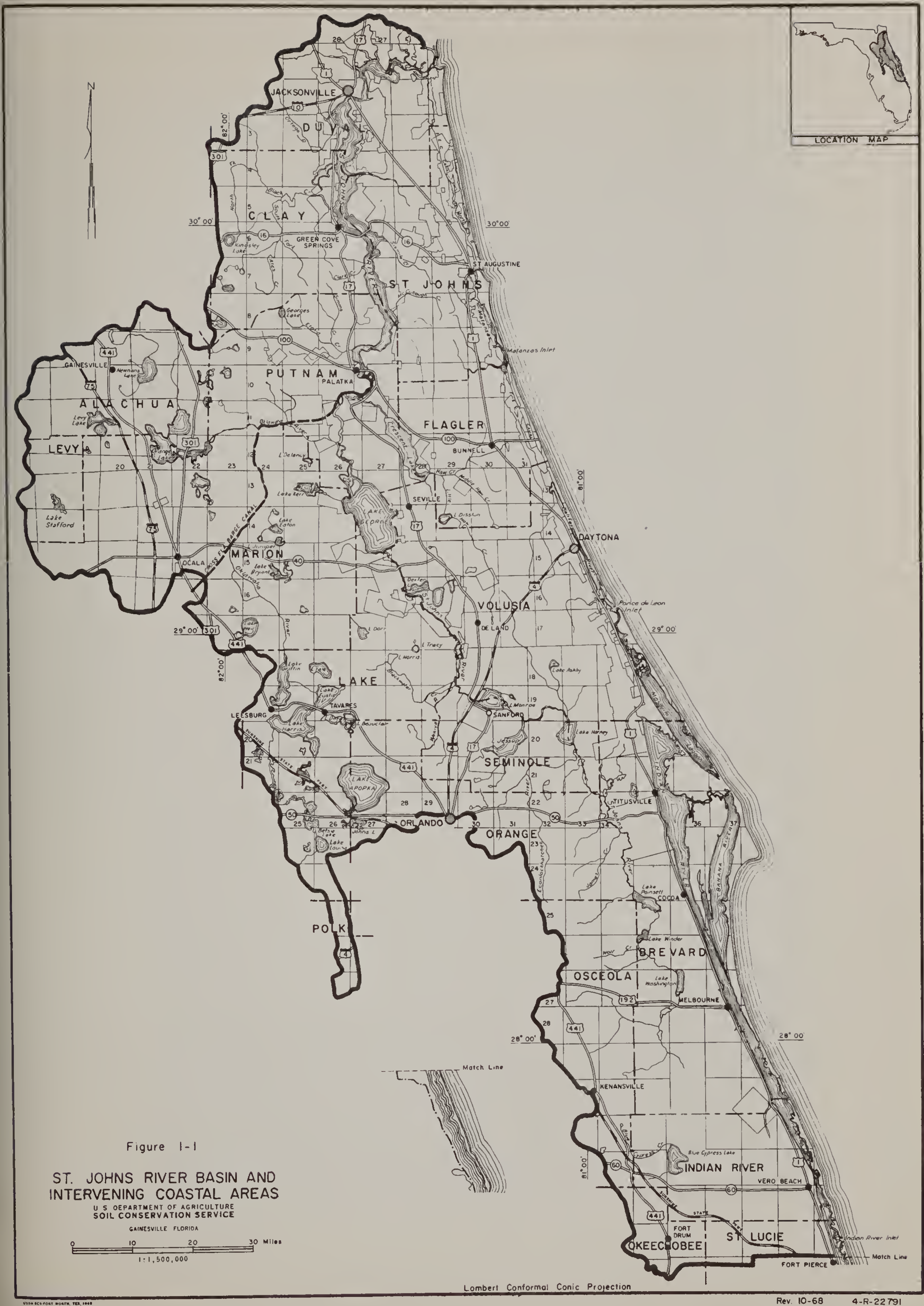

Figure 1-1

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GAINESVILLE FLORIDA

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Rev. 10-68 4-R-22791

AVERAGE MONTHLY TEMPERATURE
1931 – 1960
St. Johns River Basin and Intervening Coastal Areas

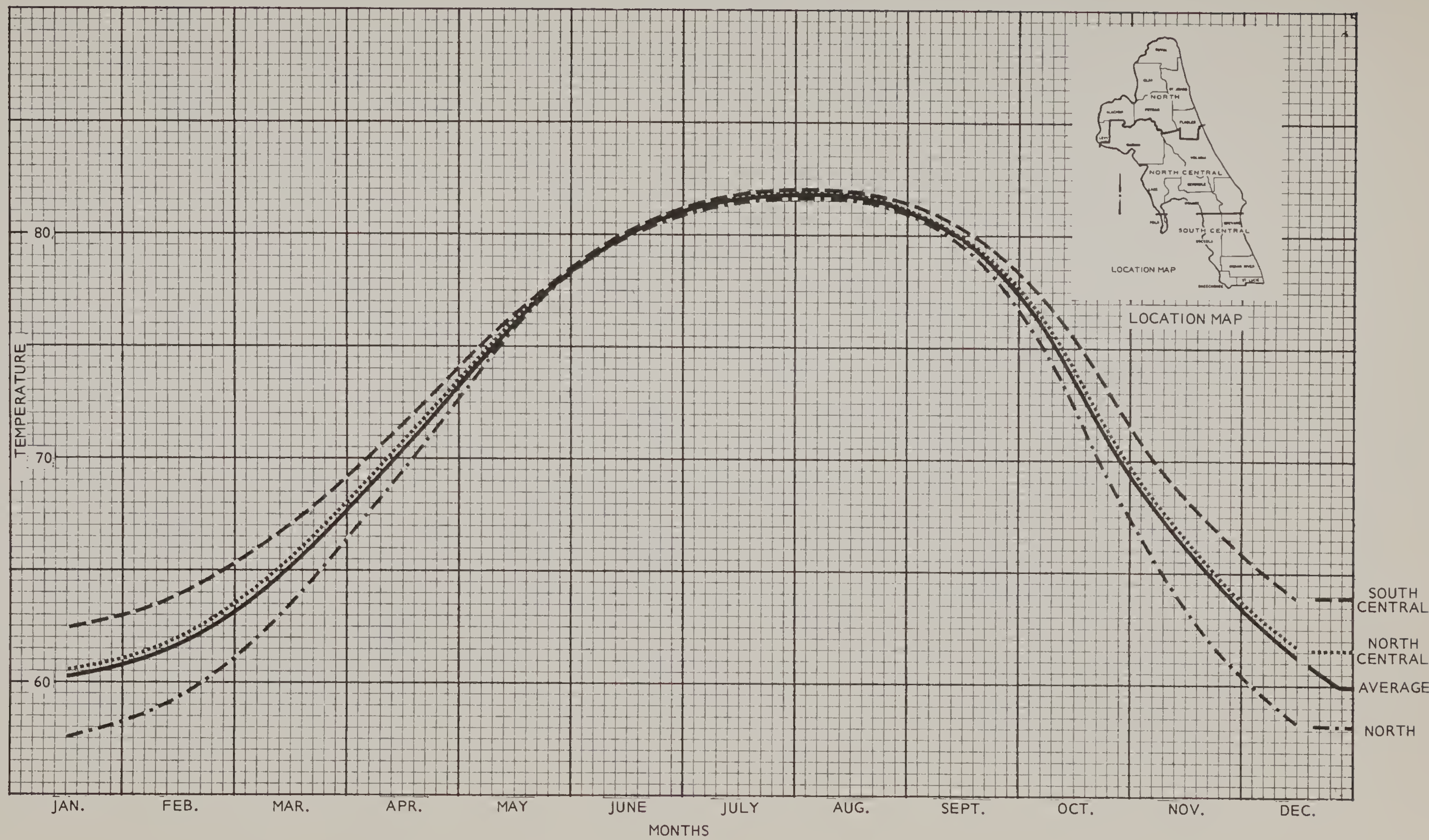

Figure 1–2

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U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

AVERAGE ANNUAL RAINFALL
1931 - 1964 (inches)
St. Johns River Basin and Intervening Coastal Areas

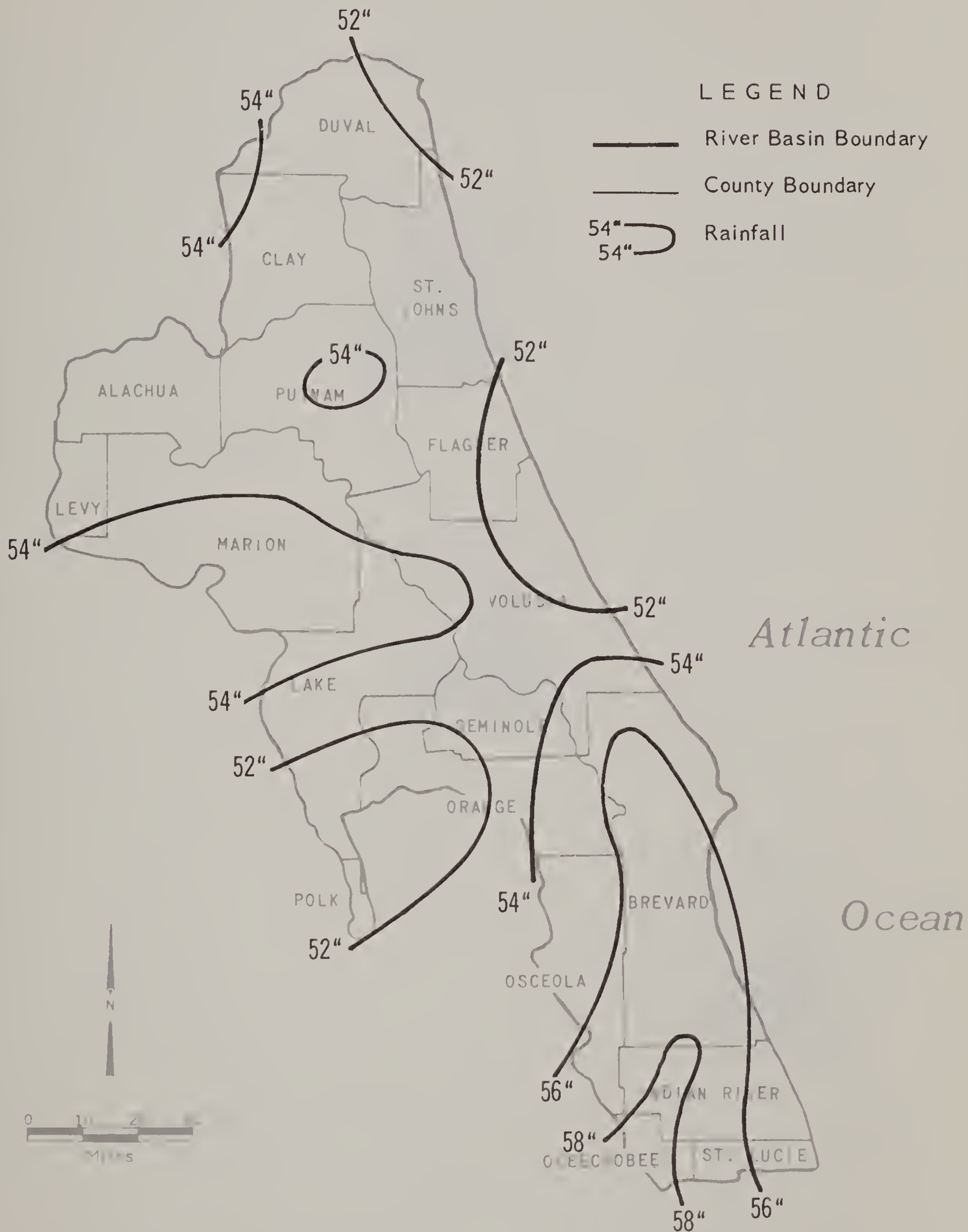

Figure 1 - 3

NORMAL RAINFALL BY MONTHS
1931 - 1960
St. Johns River Basin and Intervening Coastal Areas

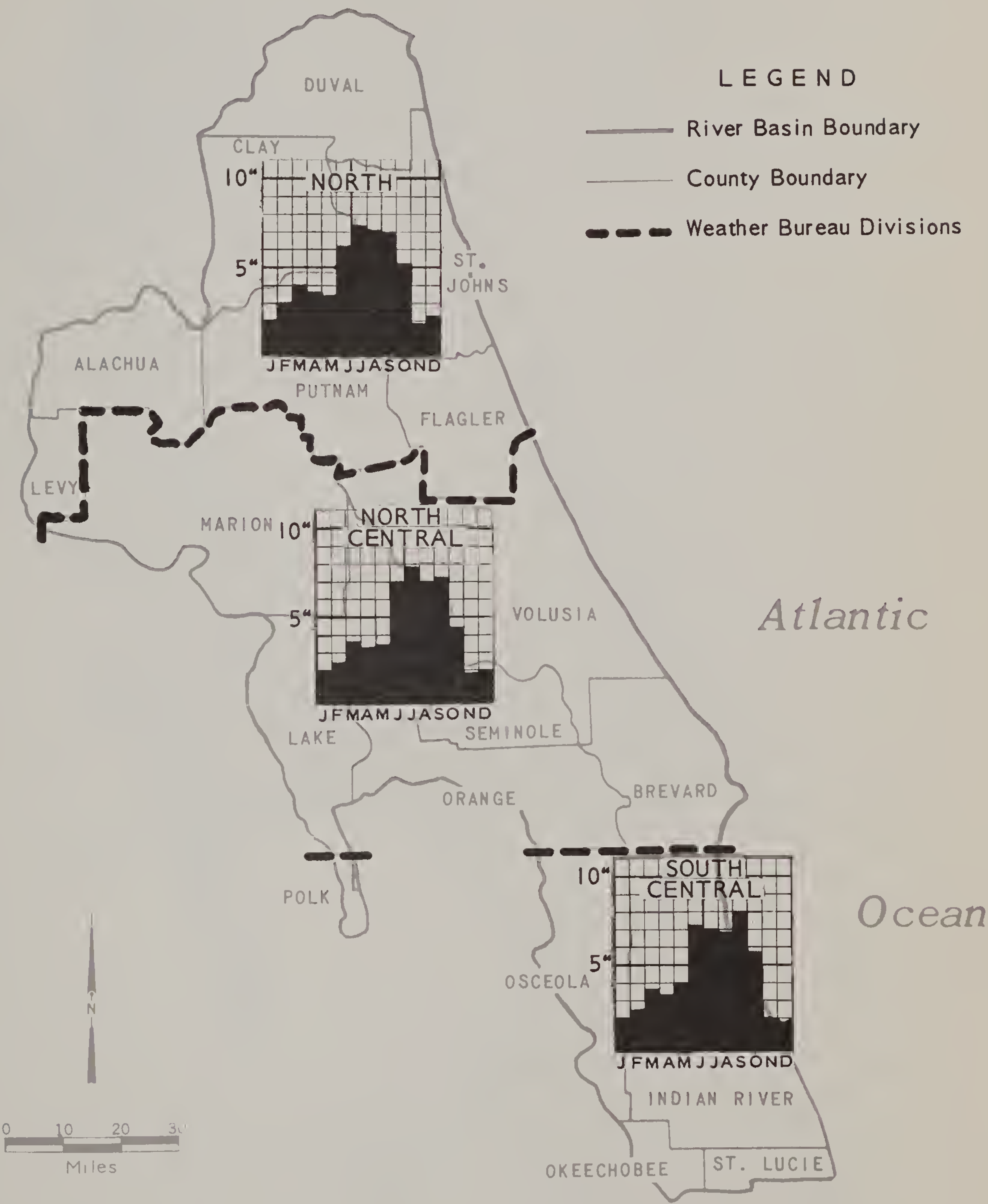

Figure 1 - 4

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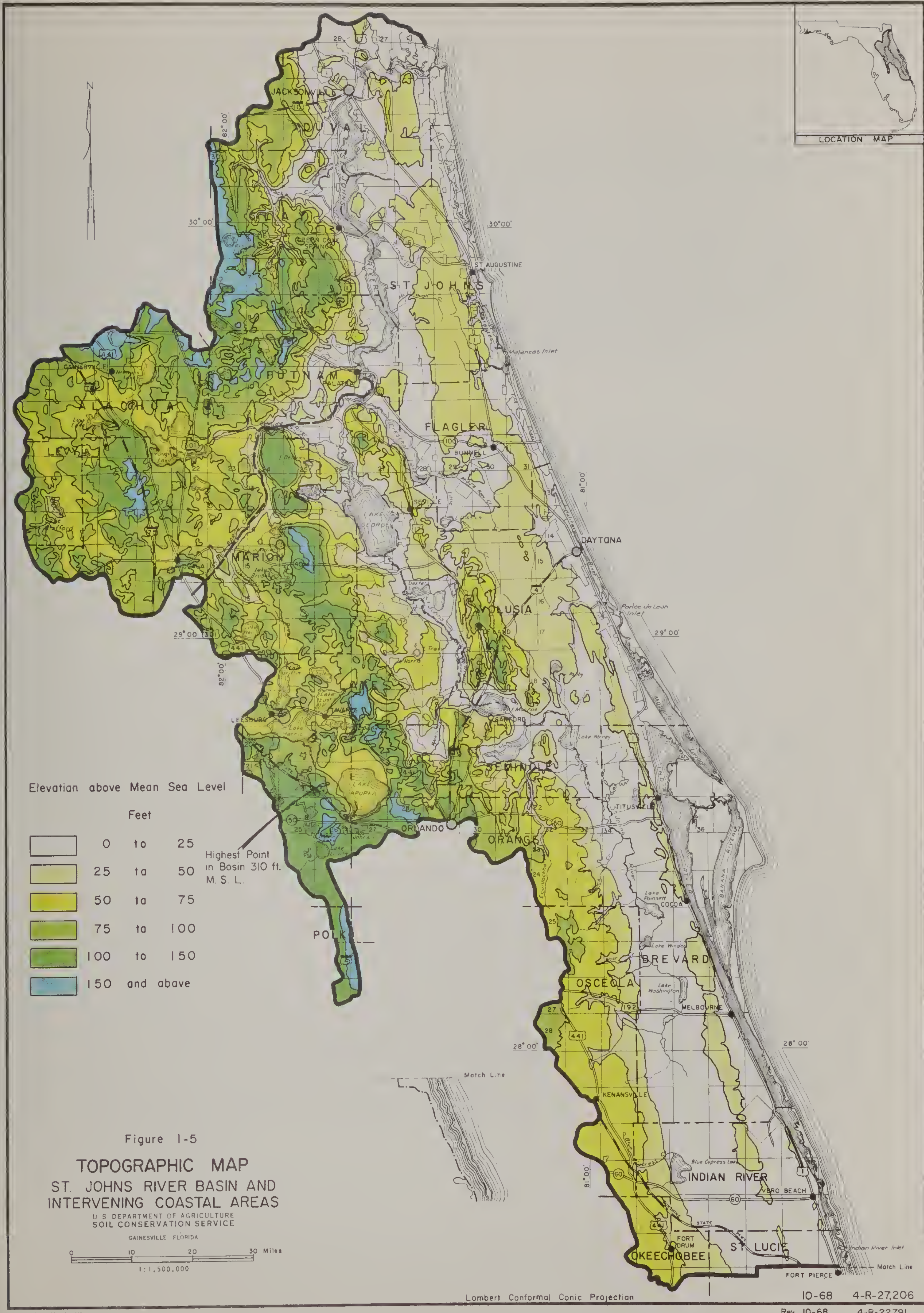

Figure 1-5

TOPOGRAPHIC MAP
ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

above mean sea level about a mile south of Howey Heights in Lake County, (Figure 1-5). Some areas are characterized by many ridges and depressions without any well defined system of surface streams or outlets. One such area, about 48,000 acres in size, in the vicinity of Keystone Heights, extends into Clay and Putnam counties, while another area in Putnam County near Interlachen, encompasses 36,000 acres. The largest of these areas within the Basin is about 523,000 acres in size and extends from near Gainesville to south of Ocala along the western boundary. These areasare considered as important sources of recharge for the groundwater supply.

Geology

The geologic formations of the Basin are entirely sedimentary. The basal formations are thick, highly calcareous sediments of the Eocene Age. They underly the entire area. The uppermost of these is the Ocala Formation, a cavernous limestone that is an important water-bearing stratum. It is exposed on the surface only in the western edge near Ocala and dips gradually to the north and south. In Duval and St. Lucie counties, the upper surface of the Ocala Formation is between 500 and 600 feet deep.

Successive periods of sedimentation and erosion during Oligocene, Miocene and Pliocene ages have left discontinuous strata of interbedded limestone, marl and unconsolidated sands and clays. The most important part of these is the Hawthorn Formation of the Miocene Age. It is a thick layer of interbedded sand, clay, limestone and marl and forms an impervious layer above the cavernous limestones. This impervious layer, or aquiclude, seals the underlying limestone and makes possible the storage of large quantities of fresh water in the limestone caverns.

A mantle of sand ranging from a few inches to several feet thick caps the entire area. This sand was deposited during successive periods of sedimentation in the Pleistocene and Recent ages. During these ages the Basin has been subjected to several inundations by the ocean, each successively less than the former. Old shore lines are readily discernible from a study of topographic maps and field observation. Five of these can be identified in the Basin. They are: Sunderland at 170 feet, Wicomico at 100 feet, Penholoway at 70 feet, Talbot at 42 feet, and Pamlico at 25 feet. Wave action, wind, and ocean currents as the sea moved in or receded, sorted the particles of exposed formations and deposited the sands that now cover the area.

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The geologic strata and their inter-relationship have greatly influenced development of physiographic features of the Basin and the kinds of soils to be found in it. This in turn has affected the potentials of different areas for various uses. The kinds of soils are directly related to the geologic materials exposed or very near the surface. They are also affected by internal drainage, which is determined by permeability of underlying strata. The configuration of the surface of the land and the great number of lakes, ponds and sinks over many areas are the result of dissolution of underlying limestone and collapse of overlying strata.

Water Resources

The U. S. Geological Survey has prepared a report on water availability in the Basin. Portions of this report are included in the State's Basin report, which will present a section on water resources, including groundwater and surface water quality and availability. In the development of the U.S.D.A. Report, water resource quantities and qualities were given full consideration.

Major Land Resource Areas

The Basin is comprised of portions of five Major Land Resource Areas as identified in "Land Resource Regions and Major Land Resource Areas of the United States", Agriculture Handbook 296, USDA-SCS, December 1965. The five Resource Areas are: 138 - North-Central Florida Ridge; 153 - Atlantic Coast Flatwoods; 154 - South Central Florida Ridge; 155 - Southern Florida Flatwoods, and 156 - Florida Everglades and Associated Areas, (Figure 1-6). Each of these Resource Areas has a unique physiography, as is indicated in the following descriptions.

North Central Florida Ridge (138). Elevations range from about 65 feet above sea level to more than 200 feet. Most of the area, however, is between 75 and 150 feet m.s.l. The surface of the land is gently undulating with many shallow depressions and sinks. There is no pronounced stream pattern and surface drainage is usually through well-drained sandy soils, or through open or partially sand-filled depressions into underlying cavernous limestone. This limestone generally underlies the area at shallow depths and the surface configuration reflects the irregular dissolution of the limestone.

Atlantic Coast Flatwoods (153). This is an area of nearly level land at elevations ranging from about 200 feet on high points in the north to about 50 feet along the Oklawaha River on the southeastern border. Typical terrain is low, flat somewhat poorly drained

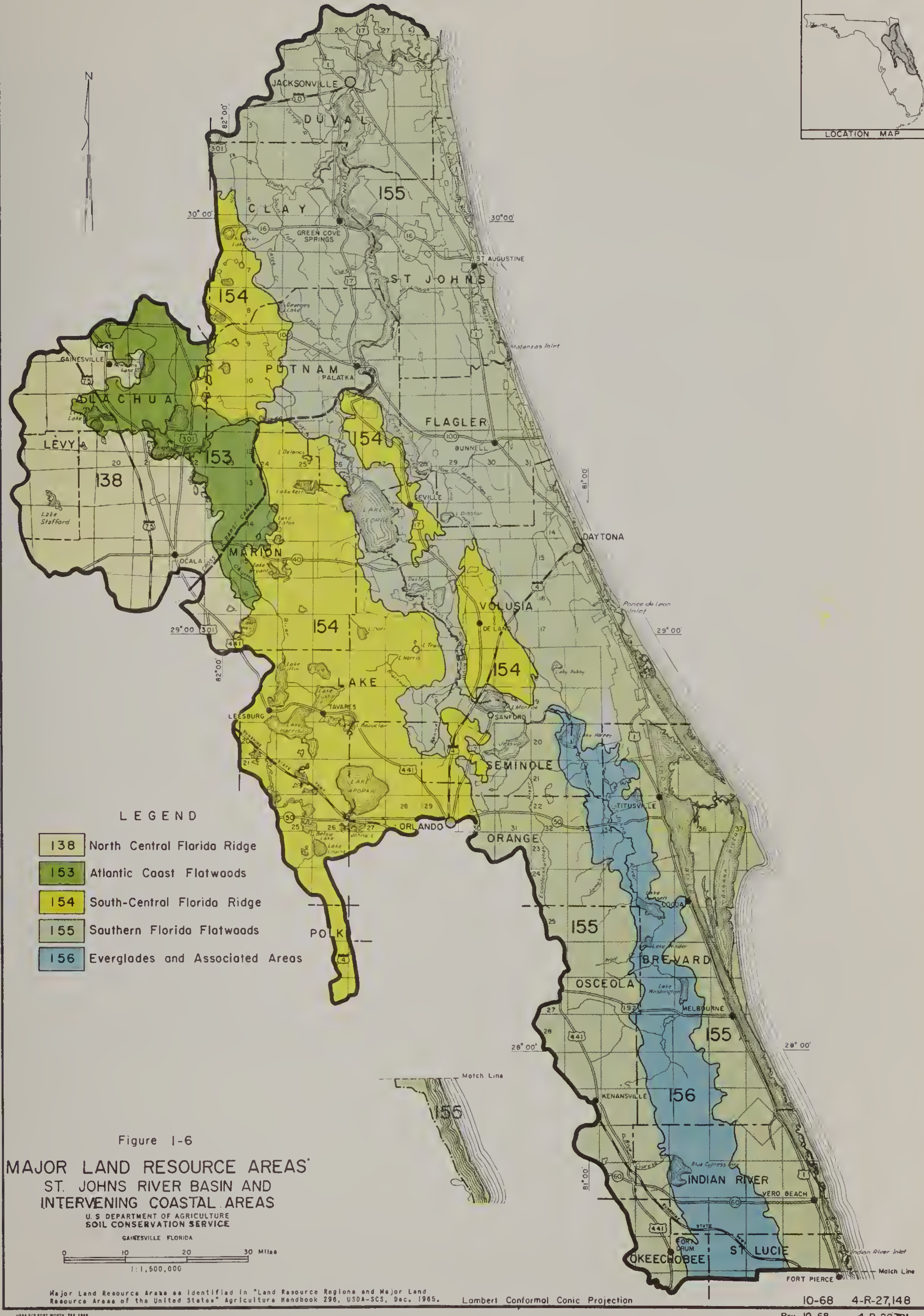

Figure 1-6

MAJOR LAND RESOURCE AREAS*
ST. JOHNS RIVER BASIN AND
INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

*Major Land Resource Areas as identified in "Land Resource Regions and Major Land Resource Areas of the United States" Agriculture Handbook 296, USDA-SCS, Dec. 1965.

USDA SCS FORT WORTH TEX 1969

ridges interspersed with numerous small and medium-sized marshes and swamps. Surface drainage is through a system of streams that move slowly through the swamps in ill-defined channels. There are several large, shallow lakes and wet prairies in this Resource Area. It is underlain generally by clayey materials that form a barrier to deep penetration of water. This causes a perched water table and ground water is near the surface over most of the area. The high water table causes most soils to be wet much of the time. The swamp areas are perpetually wet.

South-Central Florida Ridge (154). This is an area of well-drained sandy uplands. The terrain is mostly undulating to rolling well-drained sand hills with numerous large, medium and small deep lakes and shallow ponds. There is no definite stream pattern and drainage is principally into the thick sandy soils from which the water seeps slowly into the lakes and ponds. Many of the lakes are connected by drainageways. Elevations range from about 310 feet on the highest hills to about 50 feet on the lakes of the southern part. The soils are mostly deep, droughty sands. There are small areas of wet soils adjacent to some lakes and in depressions.

Southern Florida Flatwoods (155). This is an area of nearly level land that is generally less than 50 feet above sea level. The terrain is predominantly wide, low, nearly level flatlands and numerous small, medium and large swamps. Surface water moves sluggishly through a system of poorly defined channels and swamps into the St. Johns River or directly to the Atlantic Ocean. Groundwater is near the surface over much of the area and most soils are influenced by the water table. The swamps are perennially wet. A few small ridges of well-drained soils are included. The area also includes coastal beaches and associated sand dunes and sand ridges.

Florida Everglades and Associated Areas (156). This is a long, narrow, almost treeless area along the headwaters of the St. Johns River. It is a grassy plain that extends along the river in the upper two-fifths of its course. Elevations range from 5 to 25 feet above sea level. Much of the area is in perennially wet marshland and subject to frequent flooding. About two-thirds of the soils are very poorly drained and are sandy or loamy. In the rest of the area, thick beds of organic materials have collected and mucky soils have developed.

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Soils

The soils of the Basin range from deep, excessively drained sandy soils on the ridges to very poorly drained mucky soils in the marshes. Some are shallow sands over limestone; many have loamy or clayey subsoils near the surface. Others have clean sandy horizons extending to great depths. Many are strongly affected by groundwater that fluctuates near the surface. Sixty three soil series and four unclassified soil units of significance to the study were recognized in the Basin. (Technical Appendix, Section E).

Some of the soils are well suited to a wide variety of uses without special treatment. Others have severe limitations and require intensive treatment and management when used for any purpose. All land use and management programs must ultimately deal with this diversity of soil conditions. Soils information that will disclose the degree of limitation is indispensable to this study.

The soils have been mapped in detail over much of the Basin. Modern soil surveys have been completed for Lake, Orange, Seminole and Okeechobee counties. Surveys of Brevard and Marion counties are well under way, and surveys of many large and small tracts have been made in all other counties. These surveys provide a basis for making a reasonably accurate estimate of the location and extent of the most significant kinds of soils. (Technical Appendix, Section E).

A general soil map of the Basin is shown in Figure 1-7. The delineations on this map show important soil associations. Each soil association represents a group of several different kinds of soils that occur together in distinctive and repeating patterns. With a knowledge of the relative proportion of important soils in the associations and the area covered by each, it is posssible to make reliable estimates of the amount of each soil in a planning unit.

The many different kinds of soils can be grouped into a relatively few groups for various kinds of interpretations. Land capability classification is used for agricultural interpretations. Interpretations based on limitations, restrictions or hazards due to physical properties of the soil are used for non-agricultural purposes.

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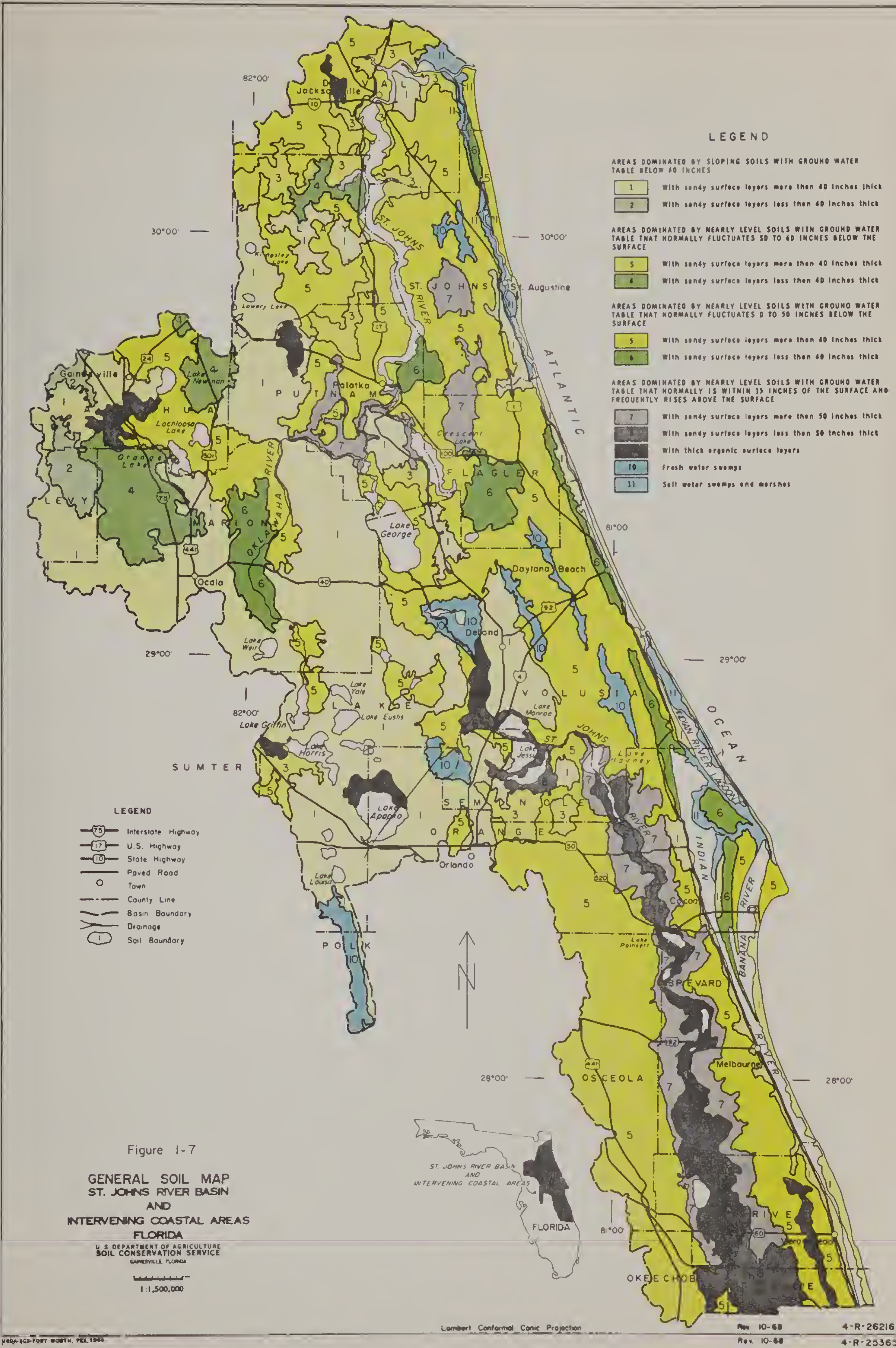

Figure 1-7

GENERAL SOIL MAP
ST. JOHNS RIVER BASIN
AND
INTERVENING COASTAL AREAS
FLORIDA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA

1:1,500,000

Interpretations For Agricultural Uses

Land capability classification as defined in "Land Capability Classification - Agriculture Handbook No. 210, USDA - Soil Conservation Service, September 1961" was used for making interpretations relating to agricultural uses. This classification consists of eight capability classes that deal with limitations or restrictions for agricultural uses and the intensity of conservation treatment needed to overcome them. They range from Class I soils that have no important limitations to Class VIII soils with very little agricultural capability. The capability classes defined briefly are:

Class I - Soils in Class I have few limitations that restrict their use.

Class II - Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III - Soils in Class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV - Soils in Class IV have very severe limitations that restrict the choice of plants and require very careful management.

Class V - Soils in Class V have little or no erosion hazard but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VI - Soils in Class VI have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII - Soils in Class VII have very severe limitations that make them unsuited for cultivation and that restrict their use largely to grazing, woodland or wildlife.

Class VIII - Soils and land forms in Class VIII will have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or aesthetic purposes.

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Subclasses are groups of capability units within classes that have the same kinds of dominant limitations for agricultural use, Some soils are subject to erosion if they are not protected, while others are naturally wet and must be drained if crops are to be grown. Some soils are shallow or droughty, or have other soil deficiencies. The three kinds of limitations recognized at the subclass level are: Risks of erosion, designated by the symbol (e); wetness, poor drainage, or overflow (w); and root-zone limitations (s).

With information about location and extent of different kinds of soils, the capability grouping makes it possible to appraise the quality of the soil resources of any part of the Basin, and the treatment needed to sustain or improve them. Many of the natural limitations or hazards can be corrected or overcome by proper treatment and management.

The approximate amounts of land by capability classes and subclasses in the Basin are: Class I, 300 acres; Class IIs, 57,100 acres and Class IIw, 236,900 acres; Class IIIs, 1,257,200 acres and Class IIIw, 844,600 acres; Class IVs, 204,700 acres and Class IVw, 2,303,000 acres; Class V, 368,500 acres; Class VI, 295,400 acres; Class VII, 917,000 acres; and Class VIII, 136,800 acres.

Interpretations for Other Uses

Interpretations for non-agricultural uses are not covered by the Land Capability Classification. However, the same basic properties of the soil that affect its capability for growing crops also affect its ability to support the weight of buildings, absorb septic tank effluent, or almost any other use of the soil. The grouping of soils for non-agricultural uses is made in terms of limitations, restrictions or hazards for specific uses. These are expressed as <u>slight</u>, <u>moderate</u>, <u>severe</u> and <u>very severe</u>. These interpretations indicate the natural limitations imposed by the soil for the proposed use and point up the kind and intensity of treatment needed to overcome these shortcomings. They have an important bearing on the suitability of land for different uses. Brief definitions of the four classes are:

<u>Slight</u>: The soil is well adapted for the use and has few if any limitations, restrictions or hazards that would interfere with the proposed use.

<u>Moderate:</u> The soil has moderate limitations, restrictions or hazards for the proposed use, but these can be easily corrected.

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<u>Severe:</u> The soil has serious limitations, restrictions or hazards for the proposed use and requires intensive corrective management if it is to be so used.

<u>Very Severe:</u> These soils cannot support the proposed use. The physical nature of the soil must be completely altered or the soil material removed and replaced by more suitable materials.

Some of the most important soil properties affecting these interpretations are: wetness, flood hazard, texture and consistence of different layers, depth to rock, permeability, traffic supporting capacity, static weight bearing capacity, slope and erodability. Some of these such as wetness, affect all uses. Others such as traffic supporting capacity, affect only one or two. Soils with excess water are placed in "w" subclasses. Those without wetness limitations but which have some other soil related limitation are placed in an "s" subclass. The interpretations are based on a weighted evaluation of all significant properties. Low ratings for some soils are based on only one outstanding limiting property; others are limited by several unfavorable properties that must be considered in giving a proper rating.

For this report, six general non-agricultural uses are considered. The effect of soils on other uses can readily be estimated by determining the soil properties that are significant to the use and relating these to the known physical properties of the soil. The six uses considered are: residential developments, highways, septic tanks, sanitary landfills, graded roads, and recreation areas. Figures 1-8, 1-9 and 1-10 are general soil maps that show suitability for the six uses based on the degree of limitations, restrictions or hazards of the dominant soils. The percentages of soils within the Basin, according to degree of limitation, restriction or hazard for the six non-agricultural uses are shown in Table 1.1.

TABLE 1.1. - Percent of Soils Within the Basin According to Limitations, Restrictions or Hazards Inherent in the Soils for Six Non-Agricultural Uses.[1/]

Use	Slight	Moderate		Severe		Very Severe
	Percent	Percent		Percent		Percent
		"w"	"s"	"w"	"s"	
Residential Development	23	34	7	18	1	17
Highways	25	34	5	18	1	17
Septic Tanks	20	9	1	51	2	17
Sanitary Landfills	20	9	1	52	1	17
Graded Roads	2	34	20	18	9	17
Recreation Areas	2	34	20	18	9	17

1/ Consolidated from table in Section E, Technical Appendix

Natural Environment

The Basin has a natural environment which is in most respects common to the State of Florida. This is an environment of mild climate and natural beauty that makes it attractive for recreation, working and living.

Large areas of forestland provide protective cover for watersheds and serve as important recharge areas for groundwater. They supply raw material for forest-based industries, habitat for wildlife, forage for livestock, and opportunities for recreation.

There are numerous lakes, ponds and streams that provide good fishing and other forms of relaxation in the outdoors. They also provide important sources of fresh water for irrigation and municipal uses. Several springs - some among the larger ones in the United States - provide excellent sites for outdoor recreation for local residents and tourists. The rolling hills in some portions of the Basin, with their citrus groves, forests, and grasslands enhance the natural beauty. The policy of the State Road Department of maintaining neatly trimmed improved grasses and shaded picnic areas on highway rights-of-way is an important man-made contribution to the enjoyment of people traveling the highways. All of the above factors, coupled with the generally mild climate of the area combine to make an attractive environment.

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FIGURE 1-8

SUITABILITY OF SOILS FOR RESIDENTIAL DEVELOPMENT AND HIGHWAYS
ST. JOHNS RIVER BASIN
AND
INTERVENING COASTAL AREAS
FLORIDA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA

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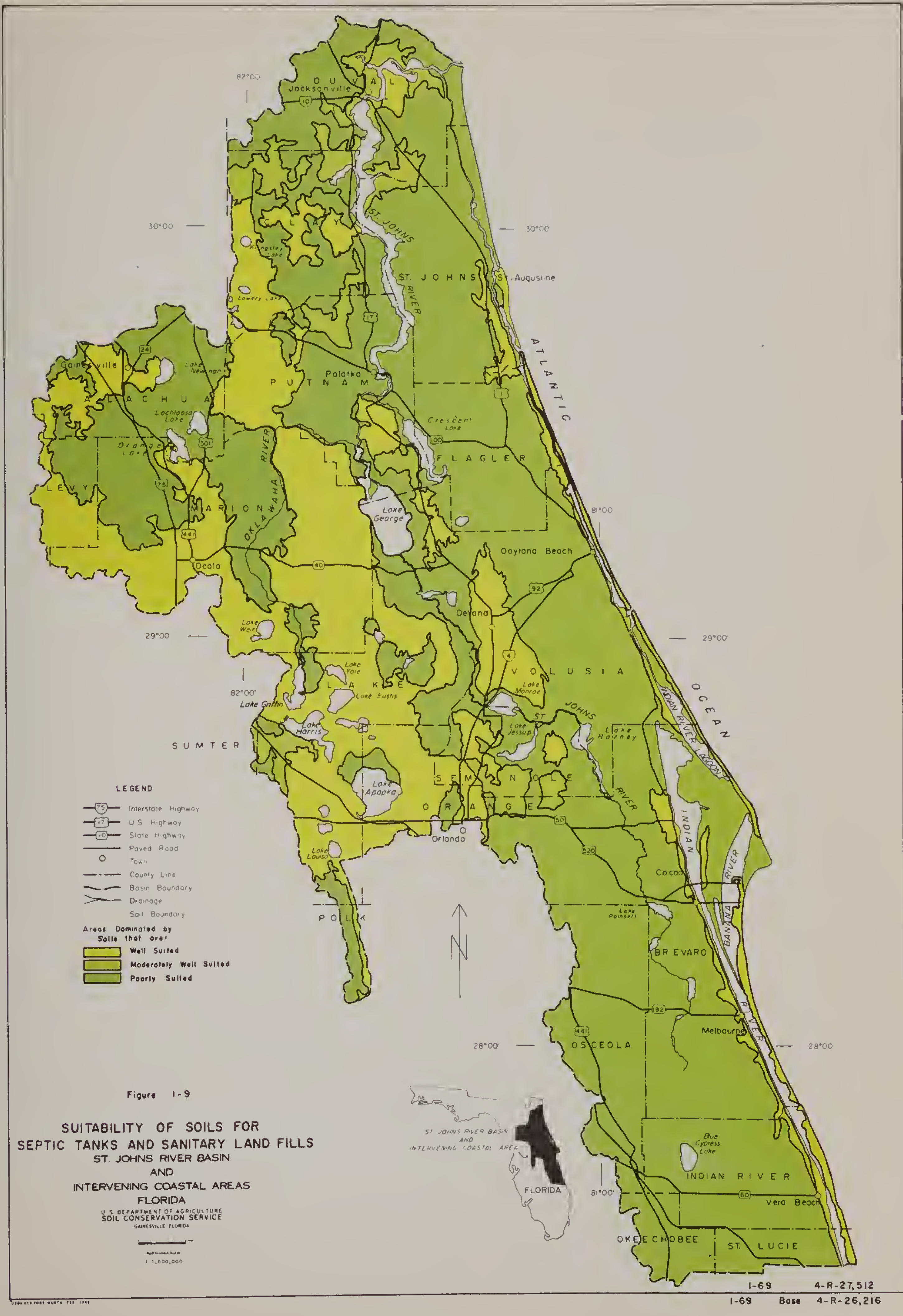

Figure 1-9

SUITABILITY OF SOILS FOR SEPTIC TANKS AND SANITARY LAND FILLS
ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS FLORIDA
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

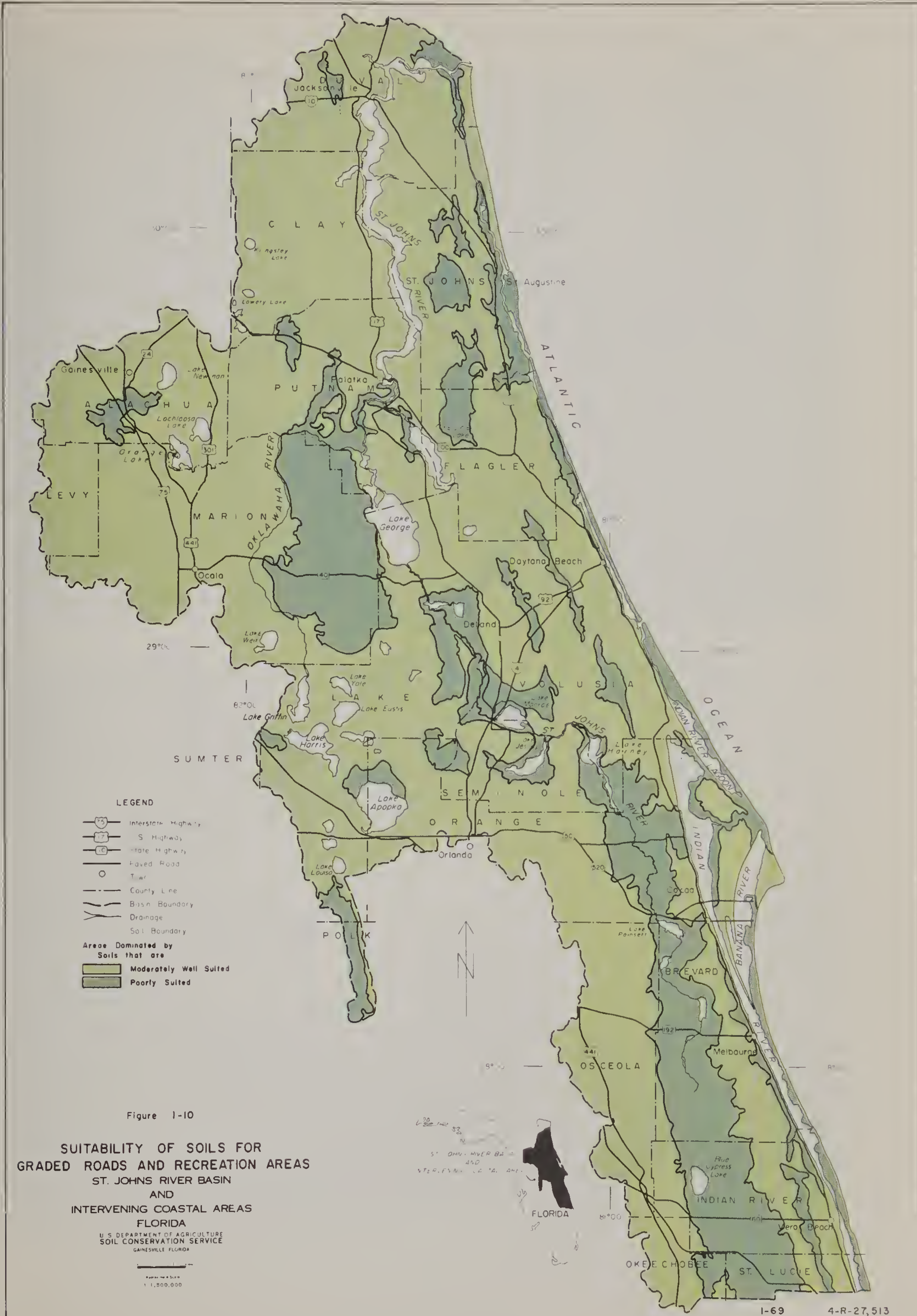

Figure 1-10

SUITABILITY OF SOILS FOR GRADED ROADS AND RECREATION AREAS
ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS FLORIDA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA

Courtesy Florida Agricultural Extension Service

Photo by Daniel O. Todd for U. S. Forest Service

Native Vegetation Enhances Scenic Beauty

Figure 1-11

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S E C T I O N I I

ECONOMIC DEVELOPMENT

Economic Conditions and Outlook

Opportunities for development are influenced by the resources and economic conditions existing in the study area and surrounding region. Knowledge of current and projected economic conditions is necessary for successful resource planning. In view of the ever increasing demands for the use of Florida's natural resources, land and water use planning is becoming extremely important.

Economic development within the Basin during the last 15 years has been much more rapid than that experienced nationally and in surrounding regions. This is evident from an examination of the major factors indicative of growth, including size and characteristics of the population, labor force, employment, and sources of personal income. Along with this growth however, go increased demands for the use of resources. Land values and taxes go higher. Water is already at a premium in certain areas. Planning for the conservation and utilization of our resources becomes more critical as time passes. Only by balancing our future needs with available resources can we hope to foster continued economic growth and a higher level of living.

<u>Population Growth</u>

Population in both the Basin and in Florida more than doubled between 1950 and 1965 (Table 2.1). By comparison, national growth for the 15-year period was 27 percent. The Basin's annual growth rate for the period was about 7 percent compared to 2 percent nationally. These comparisons point out the attractiveness of the area as a place to live and work.

In 1965, 1,487,000 persons - about one-fourth of Florida's total population - resided in the Basin. This was an increase of 20 percent between 1960 and 1965, and 108 percent since 1950. Relative rates of growth were highest in the south central coastal counties; in particular Brevard County which experienced an increase of about 370 percent during the 15 years (Figure 2-1). Other counties in which population increased at an exceptionally rapid rate were Orange, Seminole, Indian River, and Volusia. In this and subsequent references, where a county is not entirely within the Basin, the data shown is only for the area involved in this study.

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TABLE 2.1. - Total Population, Selected Population Characteristics, and Relative Change, 1950 to 1965

Item	1950		1965 1/		Change 1950-1965	
	Basin 2/	Florida	Basin	Florida	Basin	Florida
	--------Thousand persons-------				Percent	
Total population	716	2,771	1,487	5,805	+108	+109
Urban	477	1,814	1,109	4,515	+132	+149
Rural nonfarm	201	724	352	1,167	+ 75	+ 61
Rural farm	38	233	26	123	- 32	-47
	----------Percent-------------					
Percent urban	66.6	66.5	74.5	77.8	--	--
Percent rural	33.4	34.5	25.5	22.2	--	--
16 Basin counties as a percent of Florida	25.8	--	25.6	--	0.2	--

1/ Jones, Elise C., "Provisional Estimates of the Population of Florida Counties for July 1, 1965" Bulletin 14, Population Series, Bureau of Economic and Business Research, University of Florida, Gainesville, Florida, December 1965.

2/ The term "Basin" is assumed to include all or portions of 16 counties within the boundaries of the St. Johns River Basin. For those eight counties not entirely in the Basin - Alachua, Duval, Lake, Marion, Okeechobee, Orange, Osceola, and St. Lucie - estimates were made only for the portion of the county lying within the Basin. Levy, Sumter, and Polk counties were considered insignificant on the basis of the small land area involved.

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GROWTH IN BASIN POPULATION
1950 to 1965
St. Johns River Basin and Intervening Coastal Areas

Figure 2 - 1

Statistics compiled by the Bureau of Economic and Business Research, University of Florida, reveal that for every four persons added to the State's population, three are newcomers from other states. This fact indicates a healthy economic condition, particularly with regard to employment. Despite recent gains in population, there are still approximately five acres of land and inland water available for every Basin resident.

Population is becoming increasingly urban. Of the 1.5 million residents, less than two percent or 26,000 lived on farms in 1965. Twenty-four percent were classed rural nonfarm, while the majority, 74 percent, resided in cities and towns. Farm population continues to decline steadily, down 12,000 persons between 1950 and 1965.

Developing Areas

Three counties, Duval, Orange, and Brevard, accounted for almost 70 percent of the population growth between 1950 and 1965 (Table 2.2). Brevard County could not be considered metropolitan in 1950, but the development of the National Aeronautics and Space Administration (NASA) Center at Cape Kennedy has spurred rapid economic development in the surrounding region. Consequently, the center of Basin population is gradually shifting southward toward Orange and Brevard counties.

Tourist trade is of major importance along the Atlantic Coast. The interior region is largely agricultural, with few heavily populated cities and little industry. South of Orlando, economic growth has been relatively slow as has been the case in several northern counties.

TABLE 2.2 - Population of Major Growth Areas, 1950 to 1965

Area	Population in Basin 1950	Population in Basin 1965	Net Increase 1950-1965	
	Persons	Persons	Persons	Percent
Brevard County - Cape Kennedy	24,000	192,000	168,000	700
Orange County - Orlando	95,000	251,000	156,000	164
Duval County - Jacksonville	295,000	503,000	208,000	71
TOTAL	414,000	946,000	532,000	128
16 Basin Counties	716,000	1,487,000	771,000	108

Source: U.S. Census of Population, Florida, 1950, and "Provisional Estimates of the Population of Florida Counties for July 1, 1965" Bulletin 14, Population Series, Bureau of Economic and Business Research, University of Florida, Gainesville, Florida, December 1965.

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Age Distribution

The average age of the Basin population continues to decline. Between 1950 and 1960 the median age dropped from 30.4 years to 28.3 years, considerably lower than the 31.2 years reported for the State. This reflects a prosperous economy with employment attractive to young workers. The 1960 Census of Population reveals that the largest population increase during the decade was in the age group under 20 years old. In 1960, four out of every ten persons in the Basin were less than 20 years old.

Labor Force

Almost 200,000 workers were added to the labor force between 1950 and 1960, bringing the total to 475,000 (Table 2.3). Most of the increase was in Duval, Orange, and Brevard counties. Growth in these counties accounted for three-fourths of the labor force increase. The development in Brevard County was exceptional, increasing from 9,200 in 1950, to 44,000 in 1960.

Employment in the Basin has been more favorable than in the surrounding regions. In both 1950 and 1960, the Basin unemployment rate equaled or was lower than that of Florida, the southeastern states, and the Nation (Table 2.3). Unemployment in all areas rose during the decade; however, Basin unemployment remained relatively low at 4.7 percent. The rate was considerably higher in rural counties with little population to attract business and stimulate job opportunities.

Employment Trends

Improvements in farm production efficiency are resulting in a need for fewer agricultural workers. In most regions, agricultural employment is declining steadily; however, this is not the case in the Basin. The number of full-time workers on farms declined significantly between 1940 and 1960, but the total number of agriculturally related jobs changed very little as is shown in Table 2.4.

Agricultural employment as a percentage of total employment dropped from 12.9 to 5.4 percent during the 20 year period. Of the 23,400 agricultural workers in 1960, about 10,000 were classified as farm operators.

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TABLE 2.3. - Labor Force Composition, Age Distribution, and Unemployment 1950 and 1960

Item	1950	1960
	Persons	Persons
Basin labor force[1/]	285,410	474,843
Civilian	278,235	451,538
Employed	266,968	430,362
Unemployed	11,267	21,176
Military	6,775	23,305
Age Distribution:	N.A.[2/]	
14-17 years		14,720
18-24		73,601
25-34		111,588
35-44		114,912
45-64		142,453
65 and up		17,569
TOTAL		474,843
	----------Percent----------	
Civilian unemployment:		
Basin	4.0	4.7
Florida	4.5	4.8
Southeast	4.0	5.0
United States	5.3	5.6

Source: U. S. Census of Population, Florida, 1950 and 1960

1/ 14 years and older

2/ Not available for 1950

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Many farm operators supplement farm income by obtaining additional employment. Almost one-half of all operators worked off the farm more than 100 days in 1960. Although the percentage reporting off-farm work dropped to 43 percent between 1960 and 1965, the average remained above the national average of 32 percent. The incidence of nonfarm employment is particularly high near industrial areas. Seasonality of crop production, increasing labor mobility, and higher nonfarm wage rates all tend to draw agricultural employees into other types of work. Other than agriculture, forestry and commercial fishing were the only groups to have a decline in total employment between 1950 and 1960 (Figure 2-2).

Services, the single most important industry group with 111,000 employees in 1960, accounted for one out of every four workers. Trade and manufacturing followed services in terms of numbers employed. Together, the three occupations accounted for almost two-thirds of the working labor force.

Another indication of strong economic growth was the rapid increase in employment in finance and construction. More than one-half of the financial employment was in Jacksonville. In 1960, four out of every ten workers in the Basin held white collar positions, the higher proportion of these positions being in the heavily populated counties.

Forestry Employment

The forestry phase of agriculture in the Basin contributes 6,700 man-years of employment annually, supplying primary wood using industries with raw material, manufacturing it into useable wood products and harvesting naval stores. Seventy-six percent of the manpower is utilized in harvesting pulpwood and manufacturing pulp and paper. Sixteen percent is used in logging, manufacturing lumber and other wood products, and the remaining 8 percent is used in harvesting naval stores. Nearly all of these activities are confined to that part of the Basin north of Brevard, Polk, and Seminole counties.

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CHANGES IN EMPLOYMENT BY INDUSTRY GROUP
St. Johns River Basin and Intervening Coastal Areas

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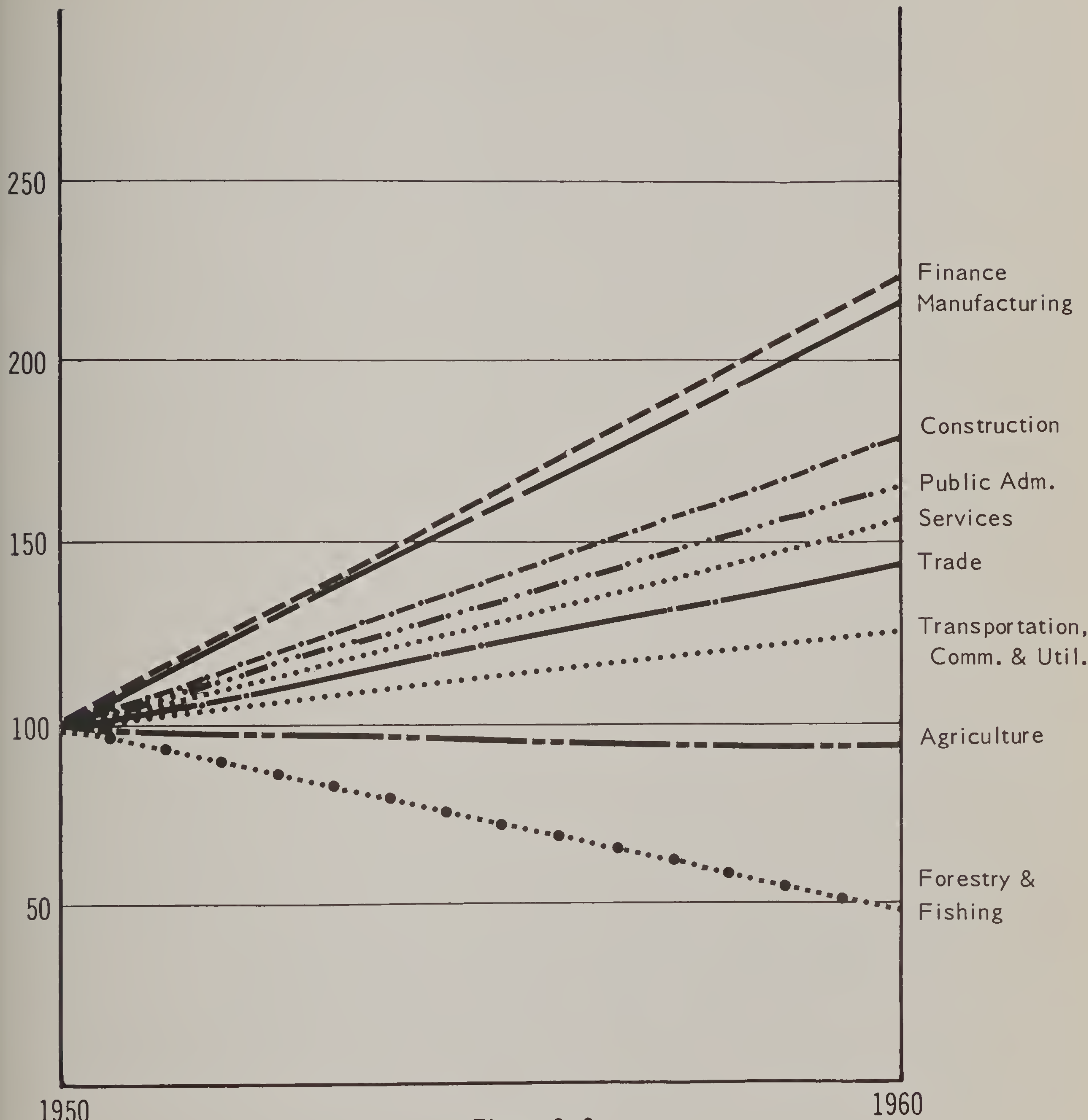

Figure 2–2

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U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

TABLE 2.4. - Civilian Employment - 1940, 1950, 1960

Industry	Total Employment 1940	1950	1960
	(Persons)		
Agriculture	23,492	24,796	23,351
Forestry & Fishing	3,358	2,591	1,279
Mining	395	607	827
Construction	10,984	22,158	39,706
Manufacturing	18,912	28,220	61,298
Transportation	13,093	18,475	18,335
Utilities & Comm.	3,671	4,661	11,095
Wholesale trade	10,492	16,451	19,914
Retail trade	30,488	47,250	72,710
Finance & Insurance	6,179	10,733	24,046
Services	52,792	70,754	110,762
Public Adm.	6,161	15,282	25,434
Not classified	2,123	4,990	21,605
Total	182,140	266,968	430,362

Source: U. S. Census of Population, Florida, 1940, 1950 and 1960, and Growth Patterns in Employment by County, 1940-1950, and 1950-1960, U. S. Department of Commerce, Office of Business Economics, Vol. 5, S.E., 1965.

Personal Income

Basin residents earned approximately $3.8 billion in 1965, or about $2,600 each. Compared with 1950 earnings, 1965 total personal income increased almost 300 percent. Counties reporting the largest percentage increase in total personal income between 1950 and 1965 were Brevard, Orange, Indian River and St. Lucie. Increased spending to develop the NASA complex has served to stimulate employment and income in counties near Cape Kennedy. Income growth slowed between 1960 and 1965; however, Brevard County continued to rank first in terms of increased income, (Figure 2-3).

Since 1950, earnings in both the study area and Florida have been increasing twice as rapidly as national income. Much of this increase may be attributed to development of the Cape Kennedy area where income in Brevard County increased sharply from $24 million in 1950 to $711 million in 1965, an increase of over 2,850 percent.

Three-fourths of the Basin's personal income of $2.8 billion, was earned in three major urban counties; Duval, Orange and Brevard. From 1960 to 1965, total earnings in the three counties increased $880 million, compared to the Basin increase of $1.2 billion. Per capita income is steadily increasing; however, the $2600 received per individual in 1965 was below the national average of $2,746. (Table 2.5 and Figure 2-4).

Forestry Income

In 1965, forestland owners received $6.5 million in payment for pulpwood, logs for lumber, veneer and plywood, bolts for miscellaneous wood products, posts, poles and naval stores. Payrolls for timber harvesting and hauling exceeded $9.8 million. Payrolls for primary manufacturing were slightly over $25 million.

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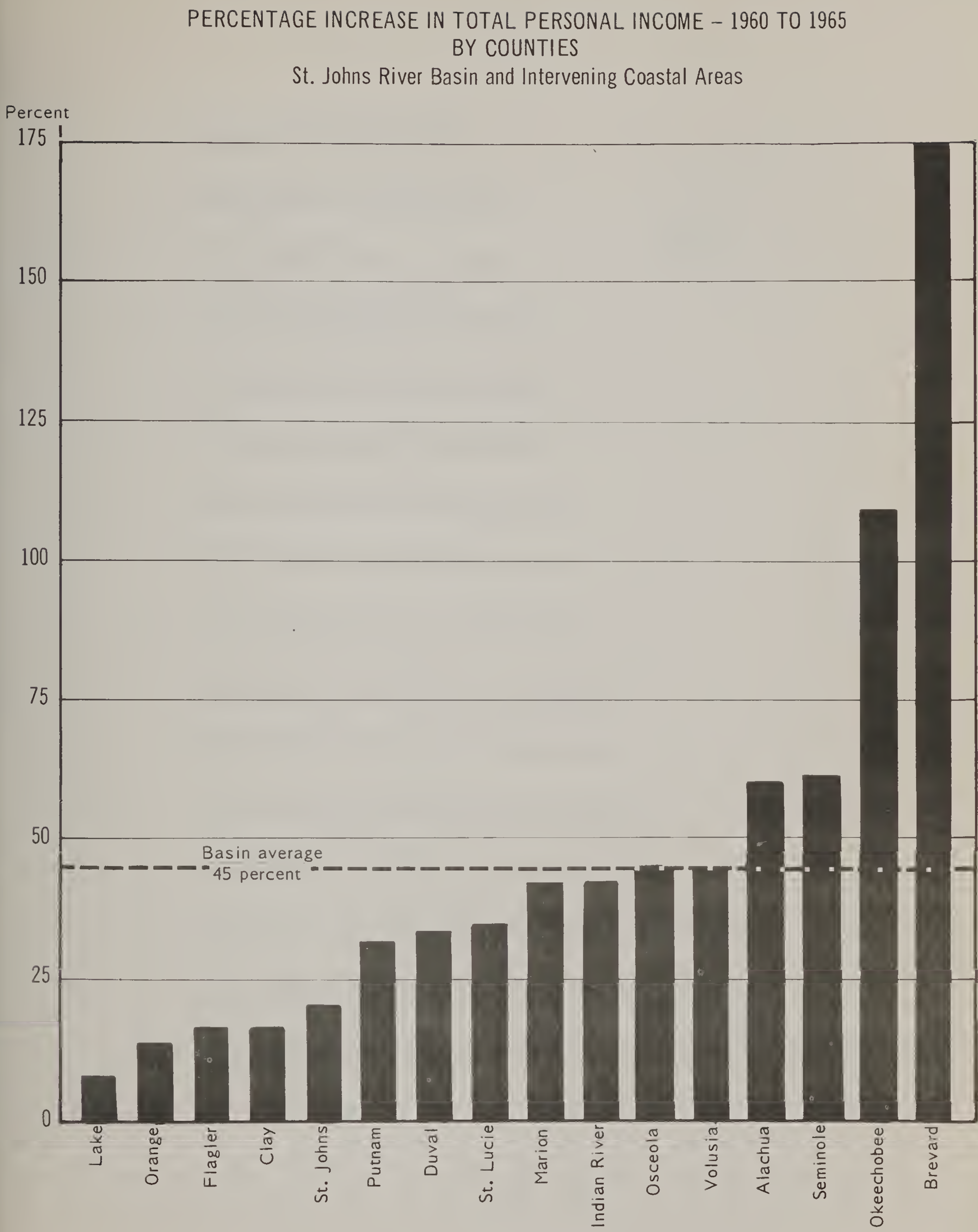

Figure 2–3

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U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

PER CAPITA INCOME BY COUNTIES
1950 and 1965
St. Johns River Basin and Intervening Coastal Areas

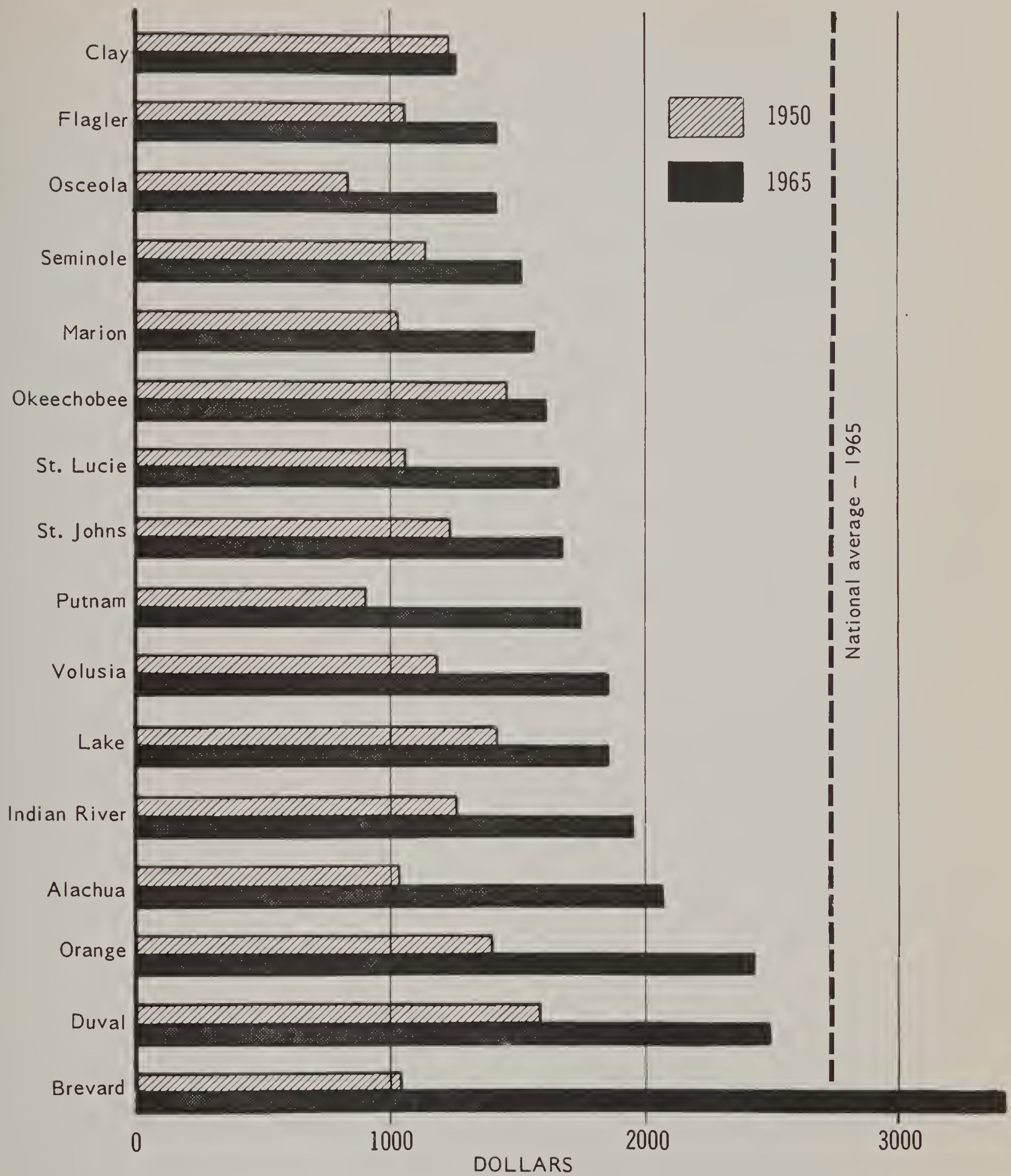

Figure 2–4

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USDA-SCS-FORT WORTH, TEX. 1969

TABLE 2.5 - Per Capita Personal Income - St. Johns River Basin and Selected Areas - 1950, 1960 and 1965

Item	1950	1960	1965	Average Annual Increase In Per Capita Income 1950-1960	Average Annual Increase In Per Capita Income 1960-1965
	------Current dollars----			Percent	
Basin	1,321	2,037	2,564	4.4	4.7
Florida	1,314	1,969	2,423	4.1	4.2
Southeast	944	1,600	2,089	5.4	5.5
United States	1,600	2,219	2,746	3.3	4.4
	---------Percent---------				
Basin as a percent					
Of Florida	101	103	106	-	-
Of Southeast	140	127	123	-	-
Of United States	85	97	93	-	-

Source: Based on data provided by the Bureau of Economic and Business Research, College of Business Administration, University of Florida and the World Almanac, 1967 Edition.

Future Economic Outlook

Economic projections cannot precisely predict the state of the economy 50 years or even 15 years from now. However, it is possible to estimate the general magnitude of the economic environment with a reasonable degree of accuracy. The projections presented in this report should be interpreted as indications of the probable future course and magnitude of the Basin's economic growth rather than precise forecasts. An indication of anticipated Basin growth is shown in Figure 2-5.

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Basin Population

An increase of one million persons is projected over the next 15 years. By the year 2000, population is expected to triple, reaching about 4.4 million, an addition of about 86,000 persons each year (Table 2.6).

TABLE 2.6 - Projected Population and Population Characteristics

Item	1980	2000	2020
	----------Thousand persons----------		
Basin Total	2,421	4,448	6,585
Urban	1,941	3,876	5,894
Rural	480	572	691
Percent Urban	80	87	90
Florida	8,907	17,648	26,352

Source: Florida Development Commission

Employment and Income

Both total employment and personal income are expected to increase quite rapidly during the projection period. If job opportunities keep pace with the population, employment should approach 1.5 million persons by the year 2000, more than triple the current level (Figure 2-5). Practically all of the increase is in the non-agricultural sector, principally for manufacturing, service and trade occupations.

Florida is one of two states expected to have an increase in agricultural employment by 1980[1/]. Farm labor productivity studies indicate that if the Basin is to supply the projected level of commodity needs, agricultural employment will have to increase from 49,000 employed in 1965 (24,000 full-time and 25,000 seasonal) to almost double this by 2020. The number of full-time farm operators should continue to decline. Consequently, most of the increased labor need is for part-time and seasonal laborers. Agricultural labor costs can be expected to rise considerably, consequently emphasis will be upon increasing labor efficiency and development of labor saving technology.

1/ Economic Projections by States for the Years 1976 and 2000, National Planning Association, Washington, D.C. May 1961.

ECONOMIC GROWTH PROJECTIONS

St. Johns River Basin and Intervening Coastal Areas

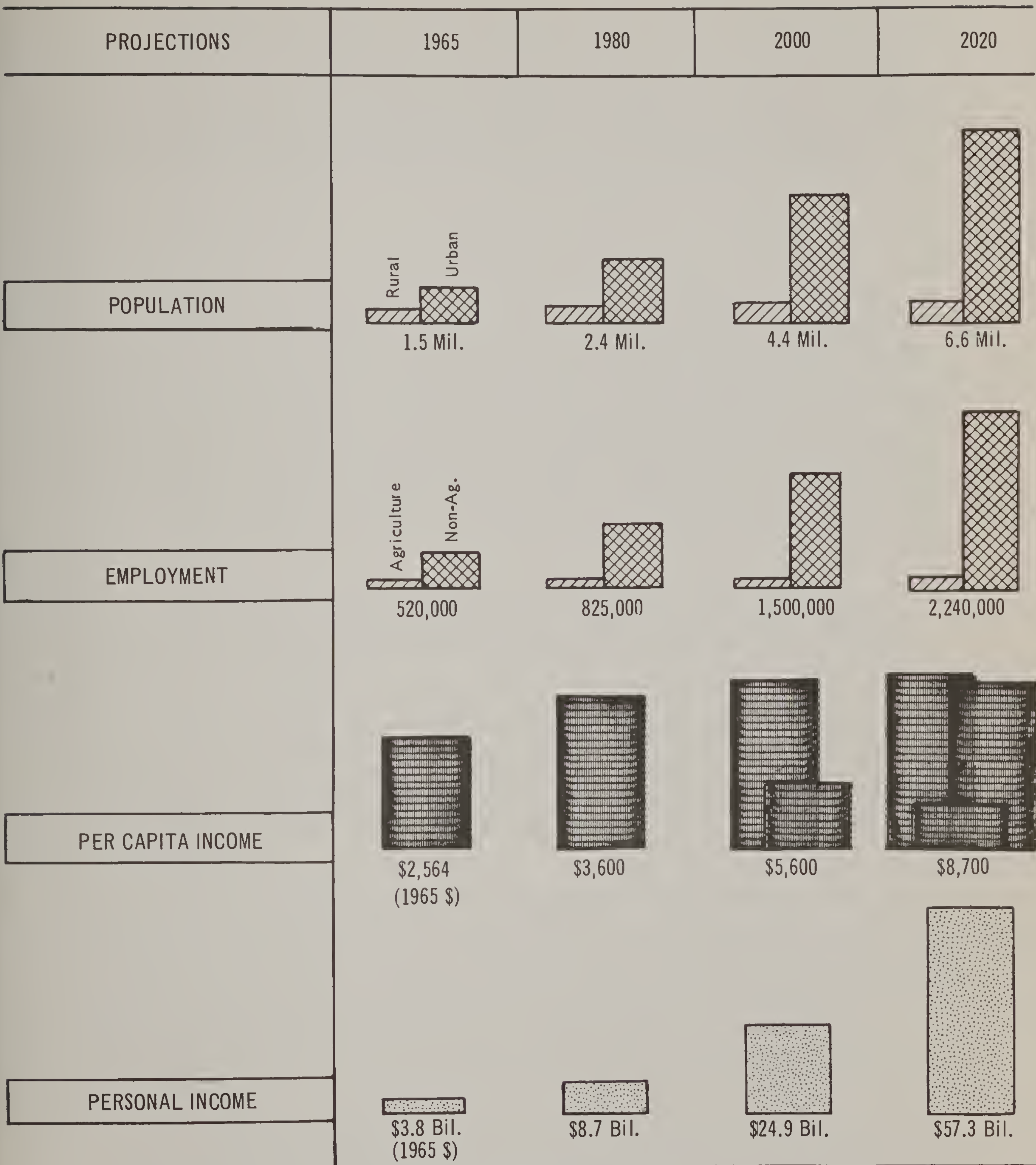

Figure 2–5

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Per capita income is forecast to rise about $1,000 during the next 15 years reaching $3,600 by 1980. This would mean a total personal income of approximately $8.7 billion, considerably higher than the $3.8 billion earned by Basin residents in 1965. If employment and income continue to expand at the projected rate, total personal income could approach $25 billion by the year 2000.

Agricultural Industry

Agriculture is the single most important industry in the study area in terms of capital investment. In 1965, farming investment exceeded $1.3 billion, more than $150,000 per farm. Annual farm operating expenses are estimated currently to be about $125 million. Value of 1965 production was $266 million with additional processing and marketing operations bringing the total retail value of farm products to approximately $700 million. Agriculture and agribusiness are vital segments of the Basin economy; hence any resource development plans should carefully consider future agricultural needs for land and water.

The magnitude of agricultural interests is evident in the current land use figures. Ninety percent of the land area (5.9 million of 6.6 million acres) is currently used for agricultural purposes as is shown in Figure 2-6.

Agricultural development continues in the face of rising taxes and urban demands for additional land. The bulk of agricultural land is devoted to pasture and forests. Harvested cropland has almost doubled since 1949, with the mix of crops shifting to a heavy proportion of citrus. Crop production trends are shown in Figure 2-7.

There has been a 30 percent decrease in farm numbers since 1954. In 1965, there were about 8.500 farms in the Basin. An estimated 4,300 were full time commercial operations. Consolidation of small low income farms into larger, more profitable units has pushed average farm size to 375 acres, compared to 285 acres in 1954. Of the 8,500 farms, 450 are 1,000 acres or more in size. Included are several of the largest beef cattle and dairy farms in Florida.

In 1965, about one of every four farm operators reported their primary source of income as citrus sales. Citrus and vegetable enterprises require a large amount of seasonal labor during harvesting; hence, most labor employment is short-term rather than full-time work.

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Basin farms supply a large share of the total national production of certain commodities (Table 2.7). This is particularly evident for citrus as the study area normally produces 25 to 30 percent of all citrus grown in the United States.

TABLE 2.7. - Basin Contribution to National Production, Selected Commodities - 1965

Commodity	Basin	United States	Supplied From Study Area
			Percent
Oranges	36.3 mil.bx.	137.3 mil.bx.	26.4
Grapefruit	12.3 mil.bx.	46.1 mil.bx.	26.7
Tangerines	1.8 mil.bx.	3.6 mil.bx.	50.0
Vegetables, Fresh	395 mil.lb.	22.2 bil.lb.	1.8
Irish Potatoes	430 mil.lb.	28.9 bil.lb.	1.5

Farm product sales of $266 million and government payments of $4 million brought the total Basin farm income in 1965 to $270 million, an average of about $32,000 gross income per farm compared with a State average of $26,000. Production expenses reported in the Census of Agriculture, averaged $16,000 per unit. These costs, coupled with expenses not shown resulted in an average net farm income in the range of $7,000 to $9,000.

Of the $266 million in sales, $210 million (79 percent) was from the sale of crops, while livestock receipts totaled $56 million (21 percent). Cash farm income from the sale of citrus was $133 million. Citrus income was down slightly in 1965 as prices fell following recovery from the 1962-63 freeze. Production, value of sales, and sales as a percentage of the State are shown in Table 2.8 for the 1955 to 1965 period to indicate shifts in the Basin's supply position relative to State production in recent years.

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LAND USE – 1965

St. Johns River Basin and Intervening Coastal Areas

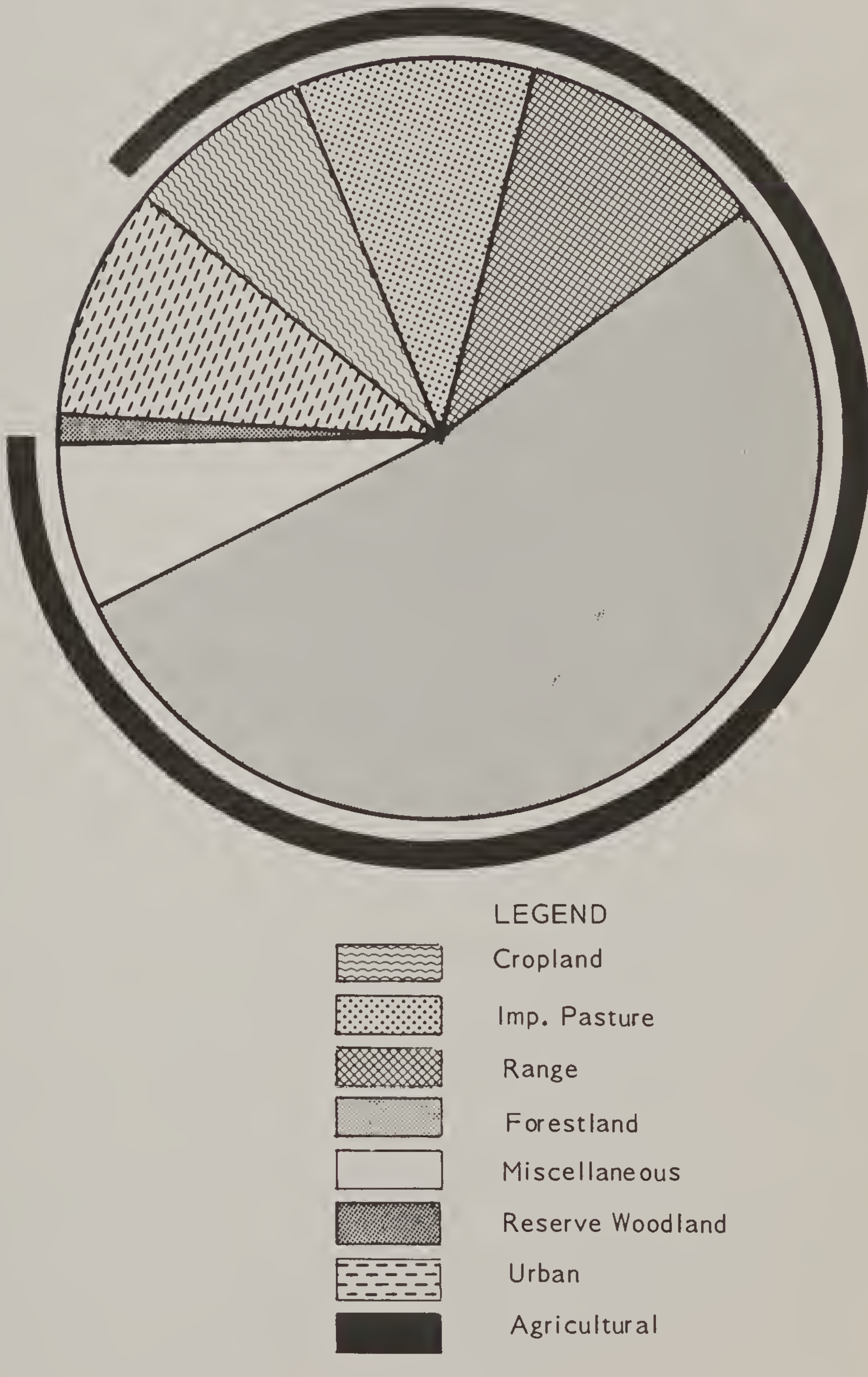

Figure 2–6

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CROPLAND USE, 1949 TO 1966
St. Johns River Basin and Intervening Coastal Areas

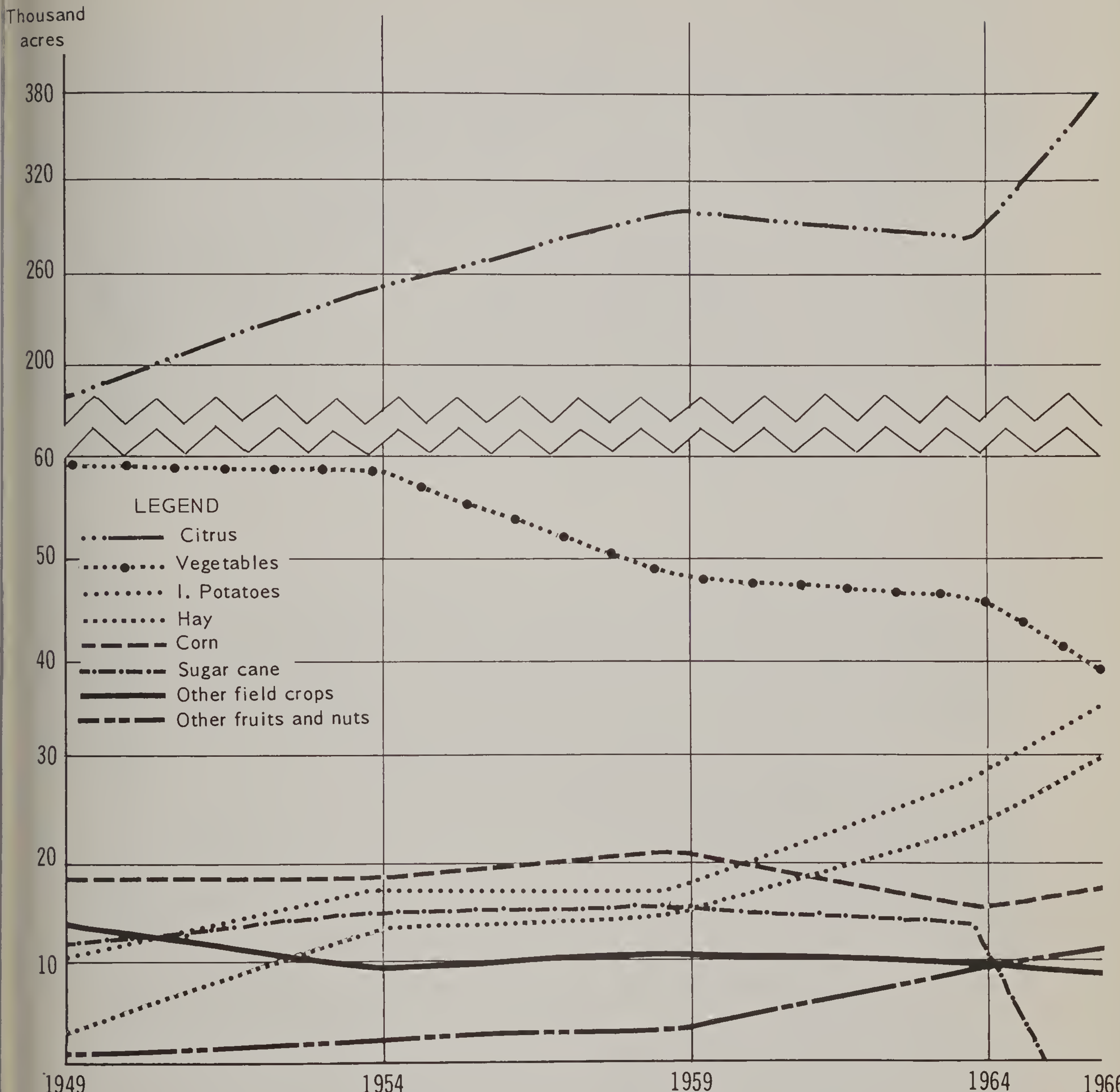

Figure 2–7

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Agricultural and Non-Agricultural Uses of Land

Figure 2-8

Agricultural Resource Use

In 1965, the base year for this report, there were 6,621,500 acres of land area in the Basin. Of this, 715,900 acres were used for non-agricultural purposes, including urban, industrial, commercial, highway and railroad rights-of-way, airports, golf courses, and other uses.

The agricultural land area comprises 5,905,600 acres with primary uses being for citrus, 357,200 acres; vegetables (including melons and potatoes) 68,700 acres; other crops, 107,500 acres; improved pasture 634,700 acres; range 707,200 acres; forests, 3,514,500 acres, and miscellaneous agricultural uses such as farmsteads, farm roads, idle land and wildlife areas, 515,800 acres (Figure 2-9).

The Basin makes a vital contribution to Florida's production of agricultural commodities, especially citrus, beef, vegetables and forest products. There are five important vegetable producing areas within the Basin, producing a variety of products. Over 40 percent of Florida's citrus is currently produced within the Basin - primarily south of Marion and Volusia counties. Considerable acreages are utilized throughout the Basin for the production of hay, seed, temporary grazing crops, ornamentals and nursery stock. This acreage includes some general field crops such as peanuts and corn.

Most counties have large areas of improved pasture for beef production. Smaller areas are devoted to dairying, or horse farms. Native range is a major land use in the southern half of the Basin.

The acreage of forestland represents about 18 percent of the total forestland in Florida and is producing over 21 percent of the State's volume of wood products. Over 1,500,000 acres of the Basin's forestland is grazed by livestock.

Citrus

An increasing share of total United States citrus production is coming from Florida groves. In 1966, the State supplied 73 percent of all citrus nationally, and it is anticipated that the share will rise to about 80 percent by 1980. Florida has the potential to supply an even larger share given acceptable market prices and adequate water supplies.

Approximately 44 percent of the State's citrus production came from the study area in 1965. This share has remained fairly constant during the past 15 years, ranging from 41 to 48 percent of the total.

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TABLE 2.8 - Production and Value of Sales By Commodity - 1955 and 1965

Commodity	1955 Production	1955 Value of Sales	1955 Share of Fla. sales	1965 Production	1965 Value of sales	1965 Share of Fla. sales
		Mil.Dol.	Percent		Mil.Dol.	Percent
Oranges	40.8 Mil.bx.	87	46	36.3 Mil.bx.	104.0	42
Grapefruit	11.7 Mil.bx.	10	34	12.3 Mil.bx.	23.0	39
Tangerines	2.3 Mil.bx.	5	46	1.8 Mil.bx.	6.0	51
Vegetables (fresh)	414 Mil.lb.	13.3	13	395 Mil.lb.	21.0	12
Vegetables (processed)	64 Mil.lb.	1.0	40	66 Mil.lb.	1.5	43
Potatoes	334 Mil.lb.	12.9	55	430 Mil.lb.	19.0	70
Greenhouse & nursery	--	10	33	--	20.0	28
Other crops	--	9.0	19	--	9.0	15
Forest products	75.8 Mil.cu.ft.	8.4	25	62.5 Mil.cu.ft.	6.5	20
All crops	--	156.6	32	--	210.0	28
Beef & veal	53 Mil.lb.	6.0	16	81 Mil.lb.1/	15.0	19
Pork	9.9 Mil.lb.	1.3	10	9.2 Mil.lb.	1.7	12
Broilers	10.9 Mil.lb.	2.9	40	13.8 Mil.lb.	2.0	30
Other chickens	2.2 Mil.lb.	0.5	19	7.7 Mil.lb.	0.7	27
Turkeys	540 Thou.lb.	0.2	20	170 Thou.lb.	0.04	7
Eggs	7 Mil.doz.	3.5	19	39 Mil.doz.	13.0	27
Milk	190 Mil.lb.	12.8	25	350 Mil.lb.	23.0	26
Other	--	1.0	--		1.0	--
All livestock	--	28.2	20	--	56.4	23
Total sales	--	184.8	28	--	266.4	27

Source: Florida Agricultural Statistics, U.S. Census of Agriculture, Florida, 1954 and 1964, and the Farm Income Situation, 1965.

1/ Livestock production estimates were on a liveweight basis.

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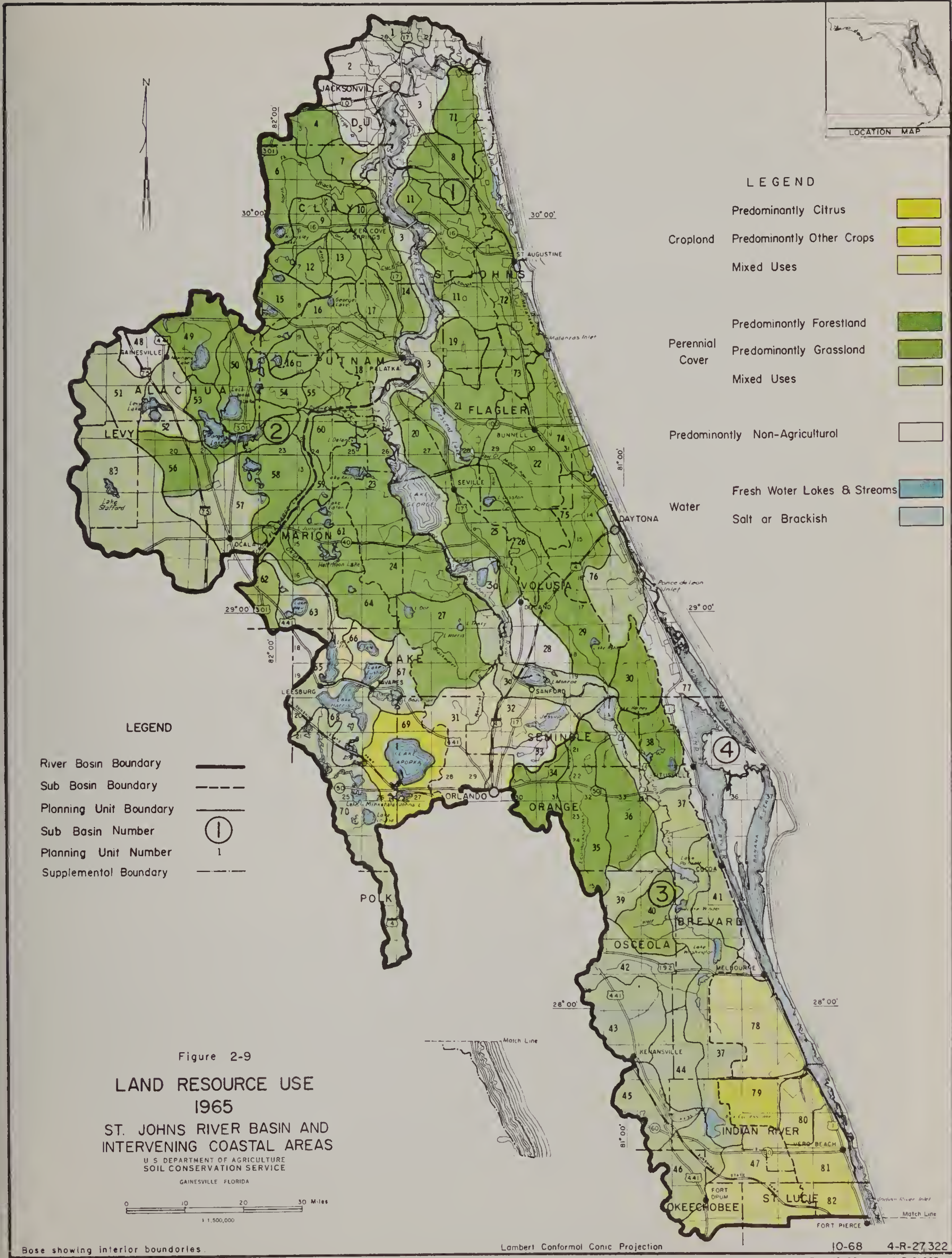

Figure 2-9

LAND RESOURCE USE
1965

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

Formerly 2-P-10.999

Rev. 10-68 4-R-21,663

More relevant is the fact that one-fourth of the nation's citrus production comes from groves in the Basin. Income from Basin groves was $133 million in 1965 consisting of $104 million from oranges, $23 million from grapefruit, and $6 million from the sale of tangerines.

Production is currently heaviest in Orange and Lake counties; however, because of new plantings to the south, production is slowly shifting toward the Indian River area where risk of freeze damage is slight. In 1949, grove owners in Indian River, St. Lucie, and Brevard counties supplied only 14 percent of the total Basin citrus output. By 1960, the share was 22 percent and in 1965, 32 percent. More than half of the grapefruit production is from groves in these three counties.

Producers began to concentrate plantings in milder climates following the 1962-63 freeze which destroyed much of the crop and many trees in northern and central Florida. Thousands of acres of citrus have been planted in the St. Lucie - Indian River area. In several instances, large orange groves have been planted for short-run speculative purposes only. Whether these groves will remain in production or revert to non-agricultural uses as supply forces prices down, remains to be seen. Plantings have increased to the point where presently, more than 70 percent of the cropland harvested is in citrus.

The availability of suitable water for irrigation will be a key factor in the success or failure of groves along the coast. Results of an aerial survey of all Florida citrus completed in 1965 indicate the potential impact of production from existing non-bearing groves. Of the 696,000 acres of orange groves, 30 percent, or 206,000 acres were non-bearing. About 93,000 acres of nonbearing citrus groves are in the St. Johns Basin.

Vegetables

Florida is second only to California in acreage of vegetables, with approximately 300,000 acres harvested annually. This is one-tenth of all commercial vegetable land currently in production in the United States. Florida's vegetable acreage has been increasing steadily over the past twenty years at the rate of about 5,000 acres annually. Value of sales was $211 million in 1966, with about $206 million (98 percent) from fresh market produce. The State normally supplies about 15 percent, by volume, of the nation's fresh market vegetables, but less than one percent of that processed. Production for processing is to a considerable extent a salvaging operation. Principal crops are tomatoes, sweet corn, snap beans, cucumbers, green peppers, cabbage and celery. These account for 75 percent of the vegetable acreage harvested.

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Harvesting is confined to the late fall and early spring seasons. In the past, heavy summer rains and resulting excessive soil moisture conditions have damaged beds and destroyed young plants. Flooding and high winds accompanying hurricanes always pose a risk to producers.

A significant share of Florida's output of potatoes, cabbage, sweet corn, celery and lettuce is grown in the study area. The Hastings area is the major supplier of early spring potatoes in the United States, accounting for about 88 percent of all production during this period. The Basin supplies about 2 percent of the fresh market vegetables grown in the nation.

In 1965, the Basin's 68,700 acres of vegetables, melons, and potatoes returned $46 million. Sales consisted of $28 million from vegetables and melons, and $18 million from Irish potatoes. St. Johns and Seminole counties, with sales of $14 million each, and Orange County ($5 million) led in sales. Production is centered in the Hastings, Zellwood, and Sanford-Oviedo areas. Three hundred commercial vegetable farms were reported in the 1964 Census with a total investment of $30 million in land and buildings ($425 per acre) and average annual operating costs exceeding $17 million. Expenditures included $8 million for hired labor, $3.5 million for custom machine work, and $3.2 million for fertilizers.

Little change is indicated in either the location, production mix, or share of Florida vegetable output coming from the Basin during the past two decades. Total land in vegetables has been increasing, and at present, the study area contains about 17 percent of the acreage harvested in the State. Record yields combined with higher prices have been the major factors responsible for the rapid rise in gross income. With population, disposable income, and per capita vegetable consumption expected to increase, market conditions should be favorable for many years.

<u>Other field crops</u>

Hay, corn, peanuts, and minor fruit crops are the other products grown in the area. Production is for use primarily on the farm; thus, income from these commodities is small in relation to the acreage involved. In 1965, sales of other field and miscellaneous crops totaled $9 million from 75,000 acres.

Expansion of beef cattle production has resulted in a recent increase in acreage of hay. More than 23,000 acres were cut in 1965, mostly Coastal Bermudagrass or mixtures of clover and other improved grasses. By comparison, in 1949 only 2,700 acres of hay were reported, and in 1959, about 13,000 acres.

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Courtesy Florida Agricultural Extension Service

The Basin is an Important Producer of Citrus and Vegetables

Figure 2-10

Corn is grown in limited amounts throughout the Basin, but particularly in Marion and Alachua counties. Twenty-five years ago, the Basin contained 50,000 acres of corn. Acreage decreased to 14,000 acres in 1965, with an estimated 8,000 harvested for grain.

Peanut acreage has remained fairly stable in recent years with the 1965 acreage at 2,500 acres. As with corn, production is centered in Marion and Alachua counties.

Sugarcane was a major income crop in Indian River County until the Fellsmere cane operation was discontinued. The Basin no longer produces cane for sugar, due to acreage restrictions, unsuitable growing conditions, and other complex problems involved in establishing a sugarcane operation.

Approximately 11,000 acres of other fruits and nuts were reported in 1965, more than half of this acreage being in Orange County. Less than 700 acres were devoted to the combined production of cotton, tobacco, sweet potatoes, oats for grain, wheat and soybeans.

Nursery and Greenhouse Products

Value of flower and nursery stock sales in Florida doubled between 1955 and 1965, reaching an estimated $71 million in the latter year. Throughout the State, about 27,000 acres were utilized for this purpose.

Within the Basin, 1,040 farms reported sales of nursery or greenhouse products in 1964. Sales for 1965 were an estimated $20 million.

The recent history of this industry is one of rapid growth, particularly near major urban areas such as Orlando. Orange County is the center of flower and ornamental sales in the Basin, accounting for nearly one-half of all transactions. Lake and Volusia counties also reported more than $2.5 million each from sales in 1965. Increased purchases of cut flowers and potted plants appear to account for the long-run growth of income; however, within the past five years, sales of shrubs and ornamentals rose by $2 million while sales of cut flowers remained unchanged at $13 million.

Beef Cattle and Calves

During the past twenty-five years, Florida has been increasing it's share of total United States beef and veal production from about 0.5 percent to 1.3 percent in 1966. In 1965, sales were a record 426 million pounds (live weight) at a market value of $83 million. Sales

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in 1966 reached $103 million. Florida ranks 26th in the nation in annual beef production and 5th among the eight southeastern states. On the basis of numbers on farms, the State ranks 13th, indicating relatively low production per cow and consequently, room for improvement in the industry. Presently, Florida ships in about 80 percent of the high quality beef consumed in the State.

Unlike most areas of the South, the study area has a major portion of its beef cattle operation located on large ranches. In 1964, 285 ranches were reported; several operations exceeded 100,000 acres each.

Producers in the Basin normally supply 18 to 20 percent of the beef and veal produced in Florida. This share has changed very little during the past 20 years.

In 1964, of the 152,000 head sold, 92,000 were classified as calves; however, on a weight basis, about two-thirds of the total production of 80 million pounds was from finished cattle. Sales totaled $12.7 million in 1964, and reached an estimated $15 million in 1965, largely as a result of higher market prices rather than increased production.

Marion County led in value of 1964 sales, reporting $2.4 million, considerably below the 1959 income of $3.3 million. The actual number of cattle and calves sold remained fairly stable, but the market price fell from 21.2 cents per pound accounting for the reduced value of sales in 1964. Other counties reporting a significant expansion of beef cattle enterprises within the past ten years are Osceola, Orange and Alachua.

About one-third of the State's improved pasture is in the study area. Much of this land could support a substantial increase in cattle production. Inadequate management inhibits success of some operations. As land taxes increase, idle land is becoming more costly; hence, pressures are building to improve idle lands so as to make them income-producing. This should have a beneficial effect on the livestock industry of both the Basin and the State.

Most industry leaders feel that the greatest potential for increasing beef production is through pasture improvement and management. A 1965 study reported that in 1960, beef cattle grazed 15.6 million acres in Florida[1/]. Of this amount only 12 percent, 1.9 million acres, was improved, yet 52 percent of all beef grown in Florida came from improved pastures.

1/ The Beef Cattle Industry in Florida: Present and Future, 1965, by Dr. James F. Hentges, Jr., Animal Science Department, University of Florida - Unpublished supplement to 1964 DARE Report.

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Improved Pasture Results in Superior Production

Figure 2-11

Dairying

In 1965, Florida dairymen sold a record $87 million in milk and dairy products. State dairy income was exceeded only by citrus and vegetable receipts. The State's 578 commercial dairies supplied 1.4 billion pounds of milk, about 1 percent of all United States production. Florida's relative share of national output has not changed in recent years.

Within the Basin, there were 132 commercial dairies in 1964 compared with 243 ten years earlier. Duval County has the largest concentration of dairy farms, followed by Orange and Lake counties. Since 1949, the number of dairy cows on Basin farms has doubled while production has more than tripled to 300-325 million pounds annually. During the same period average annual production per cow rose from 4,100 to 8,000 pounds.

Basin dairy farms represent an estimated investment of $32 million in land and buildings, and $10 million in cattle.

Poultry

Florida's share of United States egg production has risen steadily, until today the State supplies 3 percent of the Nation's consumption. In 1965, sales of poultry and eggs totaled $60 million, with $51 million from eggs. Broilers returned $6.4 million and turkeys less than $1 million.

Egg production has doubled since 1959, reaching 1.8 billion eggs marketed in 1965. Much of this growth has occurred in the St. Johns area. Broiler production has remained relatively unchanged during the past ten years.

Poultry income in the Basin amounted to $15 million in 1965. Of this, $12 million was from the sale of eggs, while broiler sales yielded $2 million. The remaining income was from the sale of other chickens; turkey production is insignificant.

Following a statewide trend, egg production in the study area increased from 50 million eggs in 1954 to an estimated 420 million in 1965. Production is centered in Clay, Duval, and Putnam counties. The Basin normally supplies about 20 percent of the eggs marketed in Florida.

Broiler sales have increased very little in recent years, probably as a result of adverse price conditions. Normally, three to three and one-half million birds are marketed each year. Clay County, with one-third of all broilers sold, and Duval County are the major production areas. Operations are on a contract basis, primarily with Jacksonville based firms.

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Pork

Pork production in Florida has been declining for several reasons. Most commonly cited causes are low market prices in relation to Midwestern markets, high feed costs, failure of producers to switch to lean breeds, and poor herd management. Currently, about nine out out of every ten pounds of pork consumed in Florida are imported. Barring unforeseen changes, this declining trend in both numbers and liveweight production is expected to continue.

Basin income from the sale of 46,000 head in 1965 was $1.7 million. For the past decade, the area has supplied about one-tenth of the State's pork output. Feeder pig sales comprise a large share of total marketings. The demand for feeder stock should improve as feed grain costs decline, with concentrated feeds making up the bulk of the feed ration.

Major Forest Industries

Three pulp and paper mills located in the northern part of the Basin produce 2750 tons of pulp per day. Other forest-based industries include forty-four sawmills, eight veneer and crate plants, five treating plants, and fourteen miscellaneous plants. The capital investment in all primary wood-using industries is estimated to be $174 million. The locations of these plants are shown on Figure 2-13.

Forestland Ownership

Forestland, including 28,000 acres of non-commercial types and reserve areas, comprises over half of the total land area of the Basin, or 3,543,000 acres. These extensive areas of forestland afford excellent protection for watersheds and prevent erosion by retarding runoff and holding soil in place. Most of the commercial timber is located north of Brevard, Seminole and Polk counties, and includes the Ocala National Forest and large acreages of forestland managed by pulp and paper companies and other forest-based industries.

Eighty-six percent of the commercial forestland is privately owned, with miscellaneous private owners controlling 35 percent and farmers owning 22 percent. Forest industries own 29 percent, most of which is controlled by ten pulp and paper companies that manage nearly 800,000 acres. The Ocala National Forest contains 10 percent, and the remaining 4 percent is owned by state, county and municipal governments.

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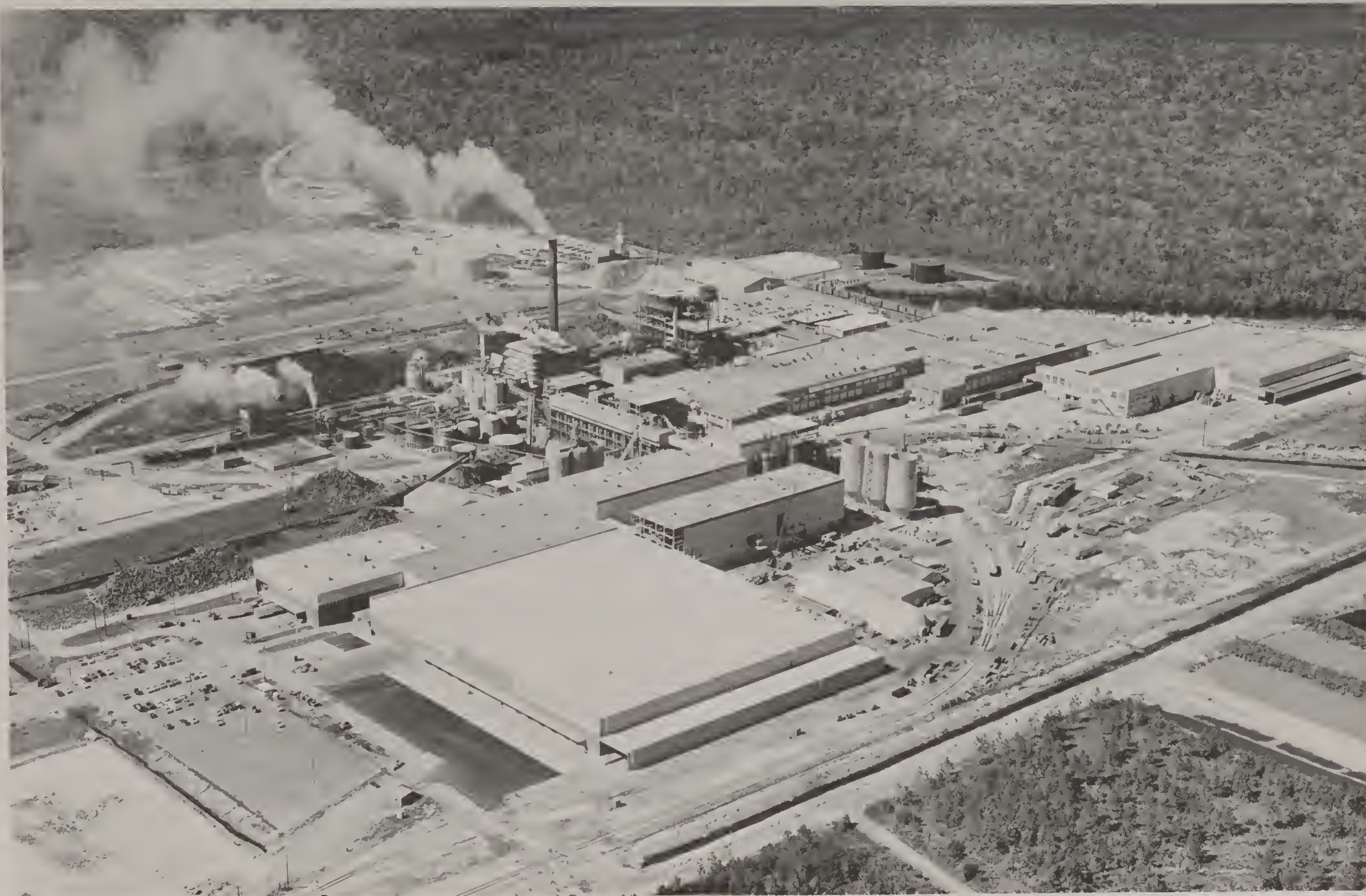

Courtesy Hudson Pulp & Paper Co.

Pulp Mills Are Important Forest-Based Industries

Figure 2-12

PRIMARY WOOD-USING PLANTS
1965
St. Johns River Basin and Intervening Coastal Areas

Figure 2–13

Courtesy U. S. Forest Service

Courtesy U. S. Forest Service

Forest Cover Adds to the Attractiveness of Waterways

Figure 2-14

Forestland Resource Use

The uses of forestland can be combined in different ways to best meet the needs of a growing population for water, recreation, timber, wildlife, and forage in an area well suited for year-round outdoor activities.

Native vegetation adds to the beauty of developed picnic areas, campgrounds, and swimming areas, and furnishes the shade necessary for the enjoyment of the users. Developed recreation sites are for the exclusive use and enjoyment of recreationists. By maintaining an undisturbed buffer zone around developed recreation sites, the surrounding forestland can be used for timber production. Forest cover adds to the attractiveness of hiking and riding trails, waterways, lake shores, and highways. Valuable recreation use is provided by maintaining buffer zones around lakes and along routes of travel through forestland, causing less than 10 percent loss in the acreage for timber production.

Hunting is an important sport and several species of wildlife are native to the area. Management practices to help meet the needs of wildlife for food and shelter are considered in cutting practices on the six wildlife management areas under cooperative agreements between the Florida Game and Fresh Water Fish Commission and the landowners. These wildlife management areas are used extensively for hunting and timber production, as are many other forestland areas.

Timber and forage production can be combined to allow grazing for livestock in some areas. After pine plantations have passed their first few critical years when damage from livestock is most likely to occur, they can, in many instances, furnish good forage. Access roads constructed for the management and protection of forestland are seeded with grass where forage is needed for livestock. Forty-seven percent of the commercial forestland in the Basin is grazed.

The effectiveness of forestland for watershed protection or as a recharge area is affected by the other uses of the area. Timber cutting and wildlife management or a combination of the two as usually practiced, are compatible with watershed use, provided the roads and trails are properly located and constructed. Grazing of forestland in this Basin is not considered as having any significant adverse effect on watershed protection. This is due primarily to the flat topography and the sandy texture of the soils. Developed recreation sites tend to increase run-off where buildings and parking lots are built and the soil and vegetative cover are disturbed. These developed recreation sites are usually limited to a few acres and involve a very small percentage of the forestland in a watershed.

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The recreational needs of large numbers of people are being met by combining timber production with other uses on forestland and still maintaining forest cover for watershed protection.

Forest Type, Stocking, Stand Size and Site Quality

The major forest types consist of 56 percent pine, 6 percent oak-pine and 38 percent hardwood. The distribution of the major types is shown on Figure 2-15. Thirty-three percent of the forestland is well stocked, 20 percent has medium stocking, and the remaining 47 percent is poorly stocked.[1/]

Twenty-three percent of the area is growing sawtimber, 27 percent is in pole-size timber, and the remainder is growing timber of smaller sizes[2/].

On 32 percent of the forestland the site quality is good, fair on 41 percent and poor on 27 percent. Site quality classes for pine and oak-pine types are determined from an index based on the height of the dominant and codominant trees at 50 years. A site index of 80 or greater for loblolly pine types and 70 or greater for all other pine types and oak-pine types is considered good. Fair site indicates a site index of 70 for loblolly pine types or 60 for all other pine types and oak-pine types. A site index of less than 60 for loblolly pine types or 50 or less for all other pine types, including oak-pine types, is classified as poor. Site quality classes for hardwood types are based on the average length of the saw-log portion at maturity. A good site is evidenced by hardwood trees with a merchantable length of three or more 16-foot logs. The presence of trees producing two 16-foot logs indicates medium site quality and trees with one 16-foot log or less are evidence of a poor site.[3/]

1/ Stocking is a measure of the degree to growing space is effectively utilized by trees. Well stocked areas are 70 percent or better stocked, medium areas are 40 to 70 percent, and poorly stocked areas are less than 40 percent stocked with growing stock.

2/ Sawtimber includes trees 9 inches and larger in diameter at breast height (d.b.h.) for softwoods and 11 inches and larger for hardwoods, and containing at least one saw-log. Pole-size timber includes trees 5 to 9 inches in d.b.h. for softwoods and 5 to 11 inches for hardwoods, and of good form and vigor.

3/ Forest Survey Release No. 57 - USDA-FS- Southeastern Forest Experiment Station

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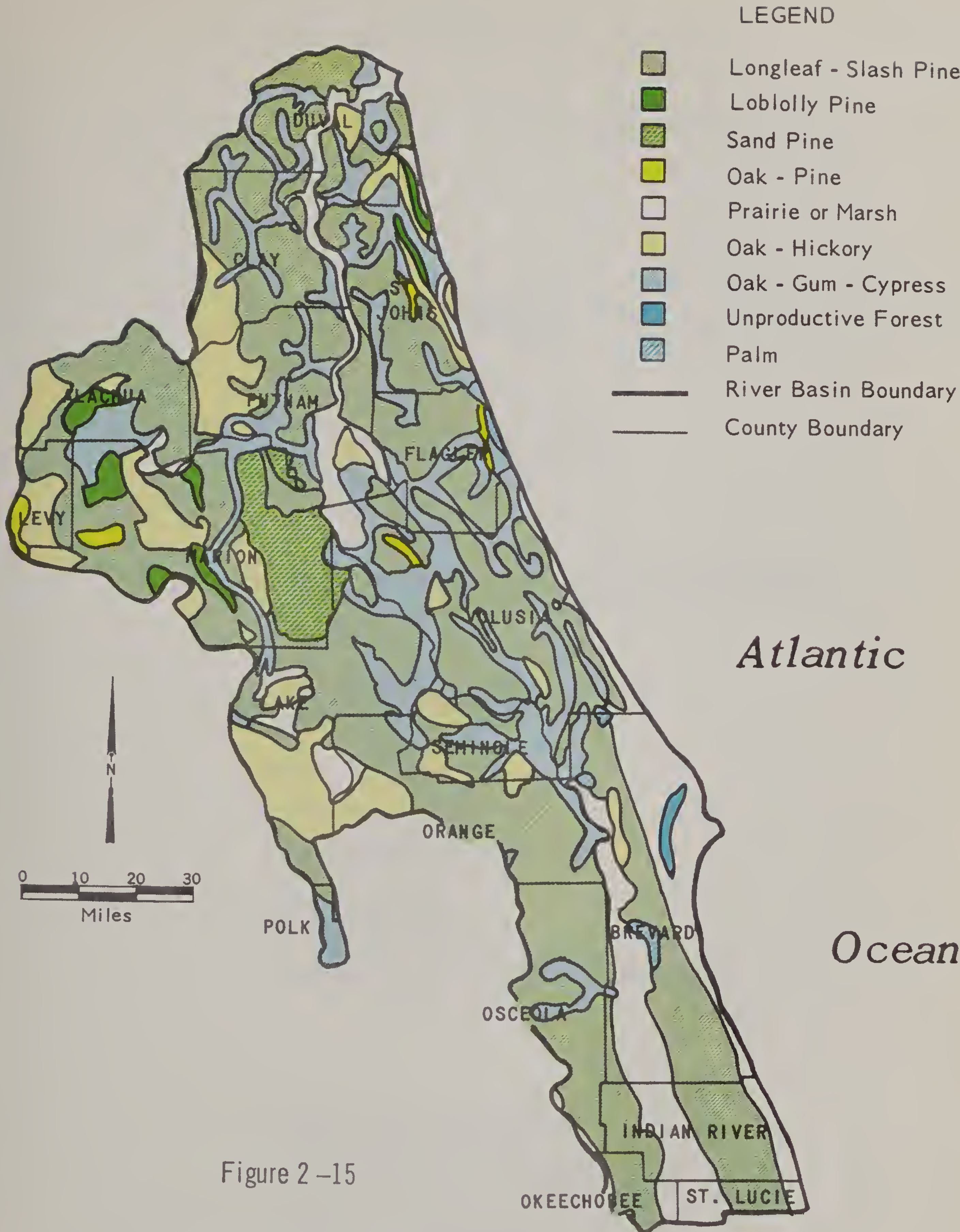

Figure 2 –15

MAJOR FOREST TYPES
St. Johns River Basin and Intervening Coastal Areas

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COMMERCIAL FOREST LAND
1965
St. Johns River Basin and Intervening Coastal Areas

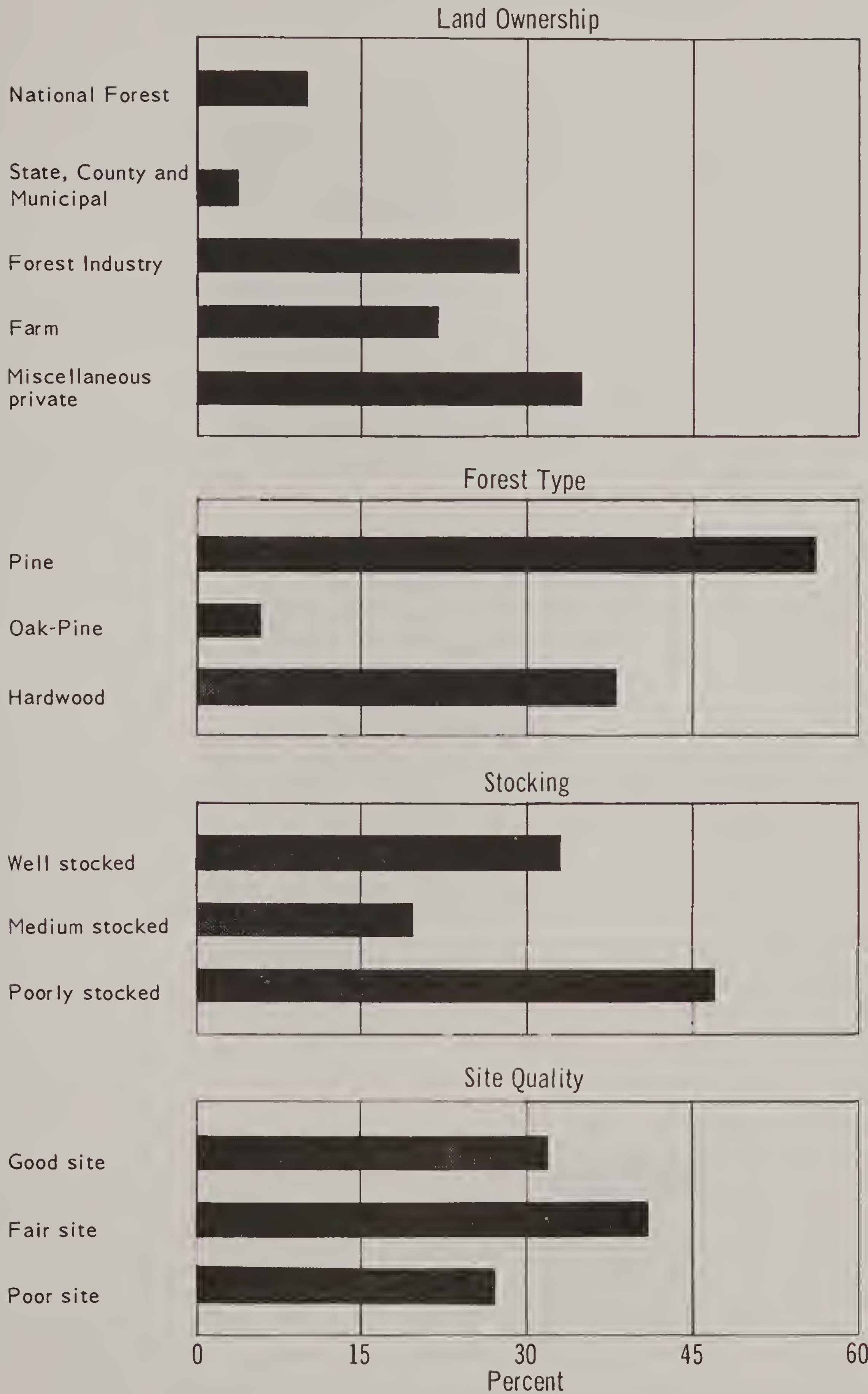

Figure 2–16

4–27090 9–68
U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

COMMERCIAL FOREST LAND
1965
St. Johns River Basin and Intervening Coastal Areas

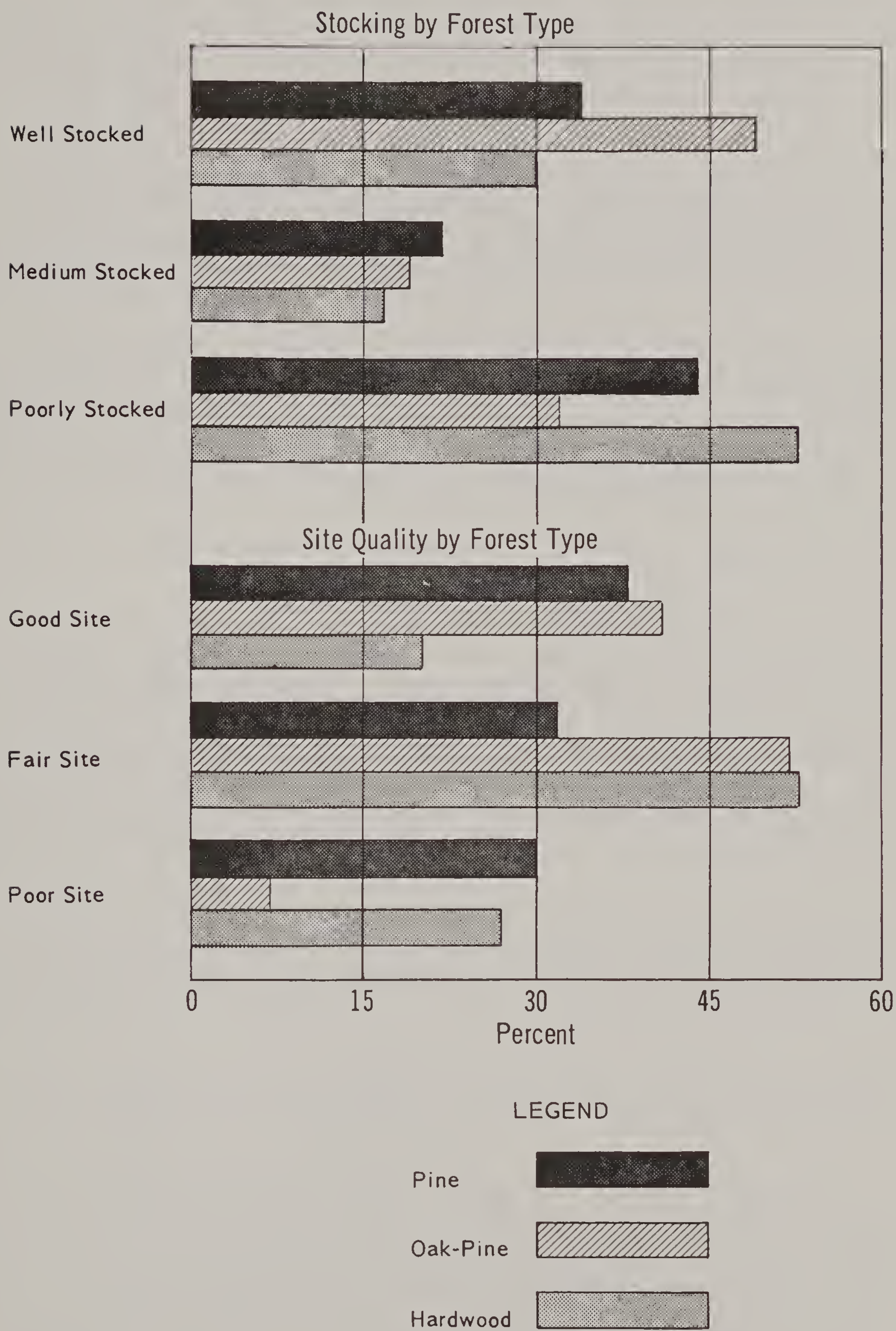

Figure 2–17

4–27090 9–68
U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

The total volume of growing stock is estimated to be 1,746 million cubic feet, of which 65 percent is sawtimber and 35 percent is pulpwood and other products. Sixty-six percent of the growing stock is softwood and the remainder is hardwood. The average volume of growing stock per acre is 497 cubic feet.

The total net annual growth of growing stock is 73.2 million cubic feet, consisting of 84 percent sawtimber and 16 percent other products. The average net annual growth is 21 cubic feet per acre, which is estimated to be only 27 percent of the potential growth under more intensive forest management.

In 1965, 62.5 million cubic feet of wood products were harvested in the Basin which was 20 percent of Florida's total. The income from stumpage of raw material for lumber, veneer, poles, piling and miscellaneous wood products was $2 million. Pulpwood stumpage brought $4.3 million and the income from naval stores was $200,000.

Agricultural Water Use - 1965

The water used by agriculture was inventoried by planning units according to source of water, method of application, and crops irrigated. The source of water was tabulated as either surface or subsurface. The groundwater or subsurface water is usually a separate system and not directly related to surface water supplies. In many instances, the groundwater supply comes from recharge areas that are far removed from the point of use and may not be connected by surface streams to the same area.

The method of application is either subsurface or sprinkler. Only soils with high water tables or with slowly permeable subsoil are suitable for subsurface irrigation. Irrigated pastures use subsurface systems almost entirely.

Crops included in the irrigation inventory are citrus, pasture, and truck. Citrus is the greatest user of irrigation water and is expected to remain so in the future.

From the 1965 inventory data, a summary was made of acres irrigated in each county, by crop and source of water (Table 2.9). Similar data, in acre-feet, are presented in Table 2.10. For partial counties, the data apply only to that part within the Basin. The irrigation water use is based on the assumption that water will be applied whenever needed for optimum production. Various research

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reports have shown that for maximum benefit from irrigation, water should be applied before the time when crops show visual signs of drought. It was assumed that, as farm management and technology improve in future years, the application of irrigation water will increase to more nearly approach the optimum needs of the crops.

Figure 2-19 shows the quantity of water used for agriculture in 1965 including irrigation, rural domestic, livestock, and golf courses. These data are shown as the depth in inches over the entire county area. Figure 2-20 indicates the limited distribution of fresh surface water in the Basin.

Three pulpmills use 27.3 billion gallons of water annually and the other primary wood-using industries use an estimated 0.1 billion gallons. Of these amounts, surface water supplies 7.6 billion gallons with the remainder from underground sources.

TABLE 2.9. - 1965 Inventory - Acres Irrigated - (1000 Acres)

	Citrus		Pasture		Truck	
County	Wells	Surface	Wells	Surface	Wells	Surface
Alachua	-	*	-	-	.3	1.0
Brevard	3.5	-	16.4	-	-	-
Clay	-	-	1.5	*	.5	-
Flagler	-	-	1.2	-	9.1	-
Indian River	49.4	-	4.0	-	17.0 1/	-
Lake	11.0	17.8	1.2	1.0	.1	4.9
Levy	-	-	-	-	*	-
Marion	5.5	3.2	.6	-	4.0	4.3
Okeechobee	1.1	1.1	-	-	-	-
Orange	16.1	2.3	1.0	-	1.0	15.0
Osceola	.7	.1	.4	-	-	-
Polk	8.6	.6	-	-	-	-
Putnam	.5	.5	2.5	-	8.6	-
Seminole	2.1	1.8	.7	.2	5.7	-
St. Johns	.1	-	.2	-	26.9	-
St. Lucie	24.4	-	4.8	-	-	-
Volusia	1.5	1.4	.4	.1	1.8	*
Total	124.5	28.8	34.9	1.3	75.0	25.2

*Less than 100 acres

1/ Includes 16,200 acres of sugarcane. It was not grown in the Basin after 1965.

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Irrigation is the Largest Agricultural Use of Water

Figure 2-18

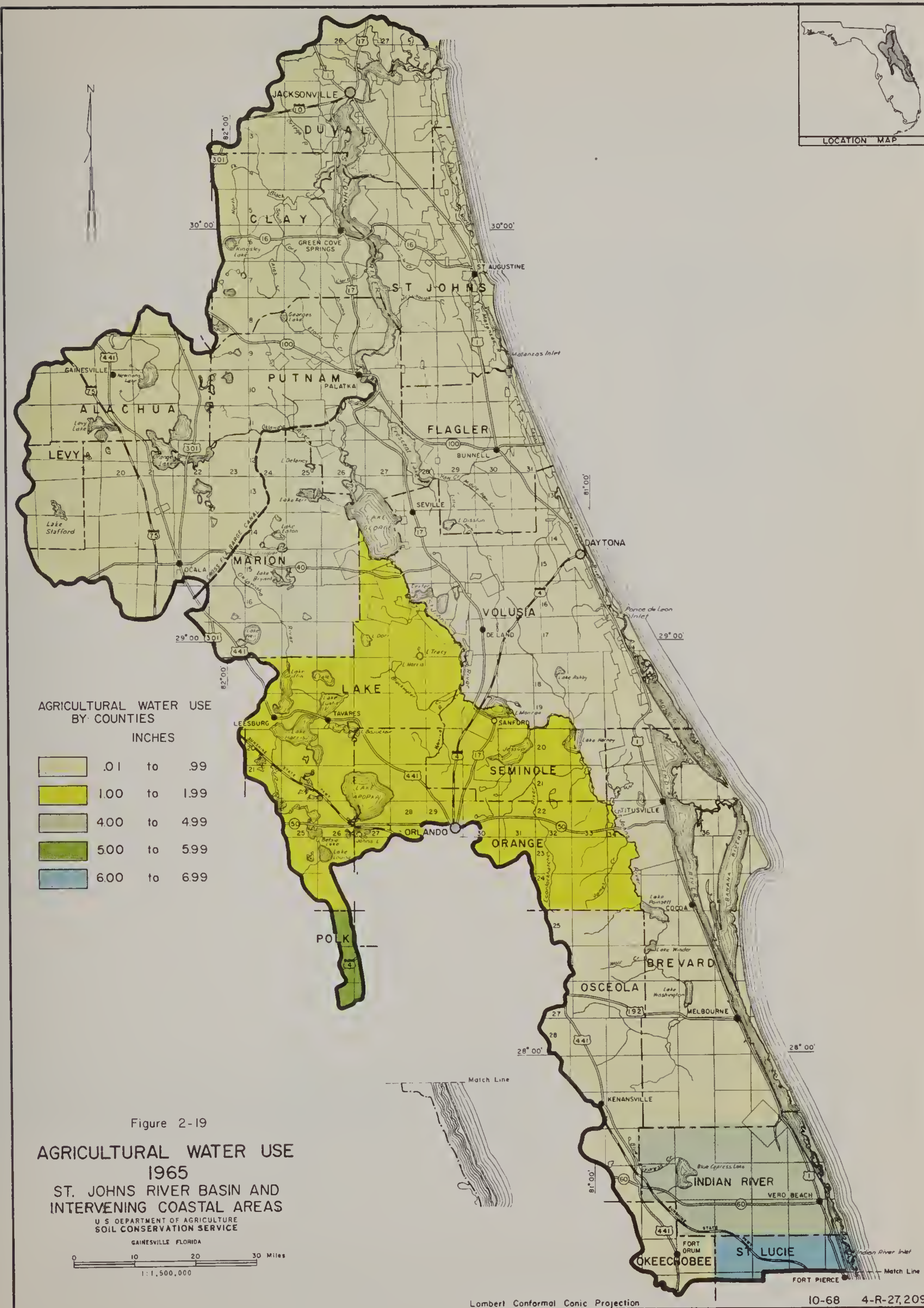

Figure 2-19

AGRICULTURAL WATER USE
1965
ST. JOHNS RIVER BASIN AND
INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

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1:1,500,000

USDA-SCS-FORT WORTH, TEX. 1969

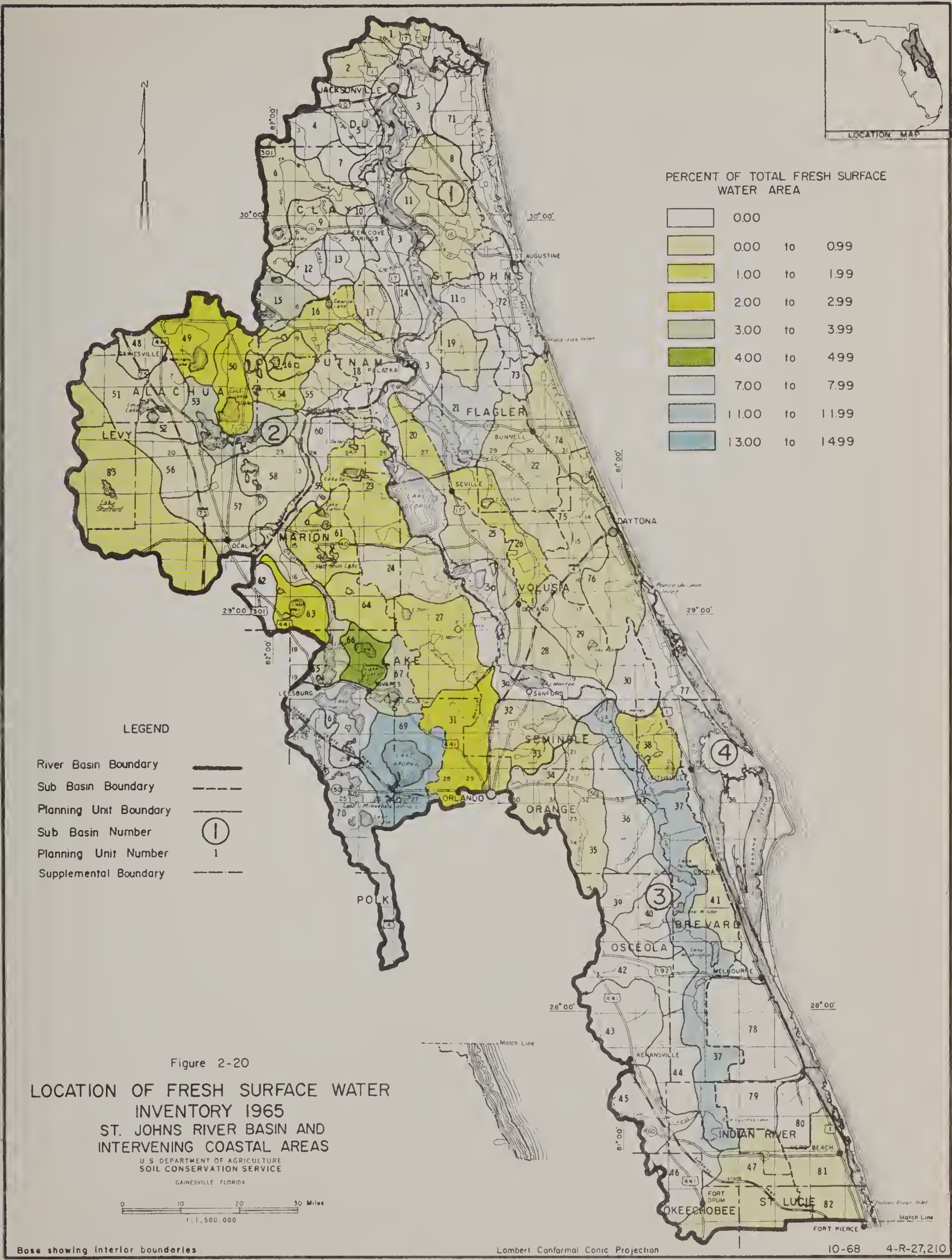

Figure 2-20

LOCATION OF FRESH SURFACE WATER INVENTORY 1965

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

Rev. 10-68 4-R-21,663

USDA-SCS-FORT WORTH, TEX. 1969

TABLE 2.10 - 1965 Inventory - Irrigation Water Applied (1000 Acre-feet)

County	Citrus		Pasture		Truck	
	Wells	Surface	Wells	Surface	Wells	Surface
Alachua	-	*	-	-	.1	.5
Brevard	6.0	-	40.2	-	-	-
Clay	-	-	3.6	.1	.3	-
Flagler	-	-	3.1	-	4.5	-
Indian River	74.2	-	9.8	-	40.6	-
Lake	19.0	30.8	3.0	2.4	*	2.5
Levy	-	-	-	-	*	-
Marion	9.6	5.5	1.6	-	2.0	2.2
Okeechobee	1.7	1.7	-	-	-	-
Orange	27.8	4.0	2.4	-	.5	7.5
Osceola	1.3	.2	.9	-	-	-
Polk	14.9	1.0	-	-	-	-
Putnam	.9	.9	6.1	-	4.3	-
Seminole	3.4	2.9	1.7	.4	2.9	-
St. Johns	.1	-	.6	-	13.4	-
St. Lucie	36.6	-	11.8	-	-	-
Volusia	2.5	2.4	1.0	.3	.9	*
Total	198.0	49.4	85.8	3.2	69.5	12.7

*Less than 100 acre-feet

S E C T I O N I I I

WATER AND LAND RESOURCE PROBLEMS

Agricultural Land Resource Problems

Problems affecting the Basin are intensified by a rapidly increasing population. These problems involve the selection of suitable lands for the orderly expansion of urban, industrial, agricultural, forestry, wildlife and recreational enterprises to meet requirements for products from the resources available. Also involved is the solution of problems associated with watershed protection, flood prevention, and agricultural water management at justifiable costs. Problems of equal magnitude, and the solutions of which are prerequisite to optimum land and water resource use, involve the conservation, utilization and management of water, both surface and subsurface.

Among the major problems encountered in developing a program for the conservation, use and management of the water and related land resources are flood damage and the lack of drainage of soils. Much of the area in the southern part of the Basin is relatively flat with poorly defined natural drainageways, interspersed with intermittent ponds. During periods of high intensity rainfall or rains of long duration, the water courses and intermittent ponds are filled to capacity and floodwater spreads over the adjacent lands. The natural removal rate is extremely slow, and although the inundation is usually relatively shallow, the duration of flooding creates extensive damage to row crops, citrus and improved pasture.

Solutions to the problems generally require comprehensive water management programs involving both flood prevention and drainage affecting relatively large areas. For this reason, the individual landowner is usually unable to solve his excess water problems since the needed water management facilities may extend a considerable distance downstream from his property. Flooding, caused by overland flow, and excess water in the soil profile caused by inadequate drainage, are often closely associated problems occurring on the same land.

The land that suffers from flooding and inadequate drainage during periods of excess rainfall is also seriously affected by drought during periods of low rainfall. With over 50 percent of the total annual rainfall occuring within a four-month period - June through September - the control and disposal of excess water during the rainy season, and maintaining a proper soil-moisture balance during periods of drought are among the most pressing agricultural problems.

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General Treatment Needs

Revised data used in updating the National Inventory of Soil and Water Conservation Needs indicate that 22 percent of the cropland in tillage rotations is adequately treated to maintain production and improve and protect the soil resources in line with national objectives. To meet these objectives for the remainder of the tilled cropland, the following should be accomplished: (1) Establish and maintain residue and annual cover on 59 percent of the area: (2) establish sod in rotations on 4 percent of the area; (3) terrace, strip crop or construct diversions on 0.3 percent of the land; (4) establish perennial vegetation on 3.4 percent of the land used for tilled crops; and (5) improve water management on the remaining 33.3 percent, including drainage and irrigation, and improved cultural practices in conjunction with water management. Fifty-seven percent of the open land formerly cropped is adequately treated. Of the remainder, 47 percent needs crop residue management and annual cover, 39 percent needs perennial vegetation established, and 14 percent needs drainage and crop residue management.

The lands used for the production of fruit occupy a larger percentage of the Basin area than that used for crops in tillage rotations. Sixteen percent of these soils are adequately treated for continued production and sustained improvement and protection. Treatment needs for the remaining area follow: (1) Establish crop residue management and annual cover on 12 percent of the soils; (2) install drainage systems for 28 percent of the area in conjunction with crop residue and cultural management; and (3) install and maintain proper irrigation water management systems and establish cultural management practices for 60 percent of the area.

The largest single use of the soil resources, except for forestland, is for pasture. The adequately treated area amounts to 27 percent. Treatment needs for the other 73 percent of the pasture area are: 40 percent - protection from overgrazing; 34 percent - improvement of present plant cover; 3 percent - reestablishment of vegetative cover; 0.3 percent - change to forestland; 4 percent - installation of proper irrigation systems; 18.2 percent - control of noxious weeds and woody plants; and 0.5 percent not feasible to treat.

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Erosion

Soil erosion is considered only a minor problem in the Basin. The Conservation Needs Inventory indicates a need for erosion control measures on less than 2200 acres of cropland. The type of treatment needed is for contour tillage on 1393 acres and strip cropping, terraces or diversions on 744 acres.

Due to the flat topography of the land and rapid infiltration rate of most soils, erosion on pastureland or forestland is not a problem. Natural stream channels are usually protected by native vegetation. Grade control structures are installed in constructed channels and road ditches where necessary.

Sedimentation

When sedimentation occurs it is usually generated by new construction; however the state and county highway departments do an effective job in treating road rights-of-way. The drainage areas of the few constructed water impoundment reservoirs are generally covered in perennial grasses or trees. Natural or planted vegetation covers the banks of the constructed water management channels in a very short time, thereby minimizing the sediment problem.

Some sedimentation occurs for short periods of time after forest access road construction, but only until road banks are vegetated with grass. Some access roads are completely seeded with grass. The sod forms a firm roadbed over sandy soils, preventing wind erosion and stabilizing the soil for travel in dry weather.

Excess Water

The Conservation Needs Inventory data and the 1965 River Basin survey inventory reveal that all agricultural uses are represented on soils that have water management needs. The general location and extent of the soil resources subject to excess water are shown on Figure 3-1.

An appraisal of the soil capabilities of the Basin indicates that agricultural crops and non-agricultural improvements are subject to excess water damage in varying degrees of severity, on 69 percent of the land. This appraisal was based on soil properties under natural conditions. The expansion of agricultural production to new areas and the continued use in present locations depend upon solutions to problems caused by excess water. After water control measures are installed, the continued use of the soils for agricultural and other purposes is dependent on the maintenance of these measures.

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The inventory of soils in agricultural use, including forestry, shows 72 percent subject to excess water hazards with 5.9 percent adequately treated. The projected future agricultural use indicates that 73 percent of the soils will be subject to these same hazards. Based on the trends in establishing works of improvement through the going programs and through new project action programs, approximately 27 percent of the area affected would be treated. The present and projected acreages of treated and untreated agricultural lands are illustrated on Figure 3-2. The percentages of agricultural lands treated and projected to be treated are:

	1965	2020
	(Percent)	
Citrus	38.6	72.3
Other Crops	50.1	69.7
Improved Pasture	17.8	61.6
Forestland	2.7	7.8

Much of the flatwoods forestland is very poorly drained with shallow perennial ponds interspersed. Waterways are often poorly defined. According to land capability classification of the soils, 73 percent or 2,559,000 acres of forestland is on soils having excess water hazards. It is estimated that the management of pine is adversely affected by excess water on over 600,000 acres of forestland for one or more of the following: access, stand regeneration, or rate of growth.

Canals dug in connection with access road construction often discharge into existing creeks or old canals with insufficient capacity to receive the additional volume of water, thus creating or adding to flood problems downstream.

In 1965, about 69,000 acres of forestland on soils IIw through Vw were considered adequately drained. Most of this water control was accomplished on land managed by pulp and paper companies.

Agricultural Water Resource Problems

Large quantities of surface and subsurface water are located within the Basin, yet there are areas where water shortages exist. The problem is one of transferring water from surplus areas to deficit areas. It is estimated that the Basin has sufficient water to meet the projected needs, provided proper distribution can be accomplished.

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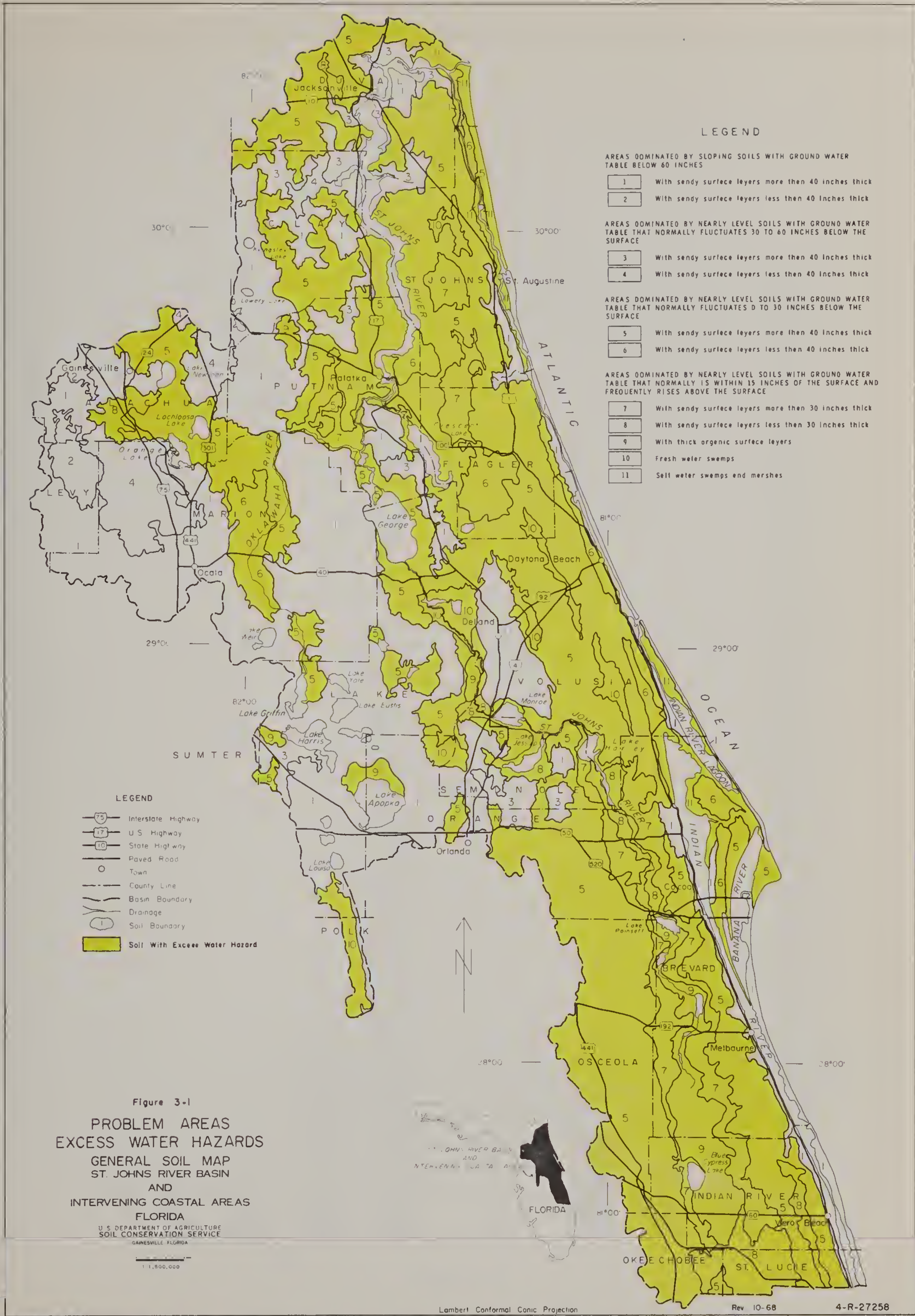

Figure 3-1
PROBLEM AREAS
EXCESS WATER HAZARDS
GENERAL SOIL MAP
ST. JOHNS RIVER BASIN
AND
INTERVENING COASTAL AREAS
FLORIDA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA

USE OF SOILS SUBJECT TO EXCESS WATER HAZARD
St. Johns River Basin and Intervening Coastal Areas

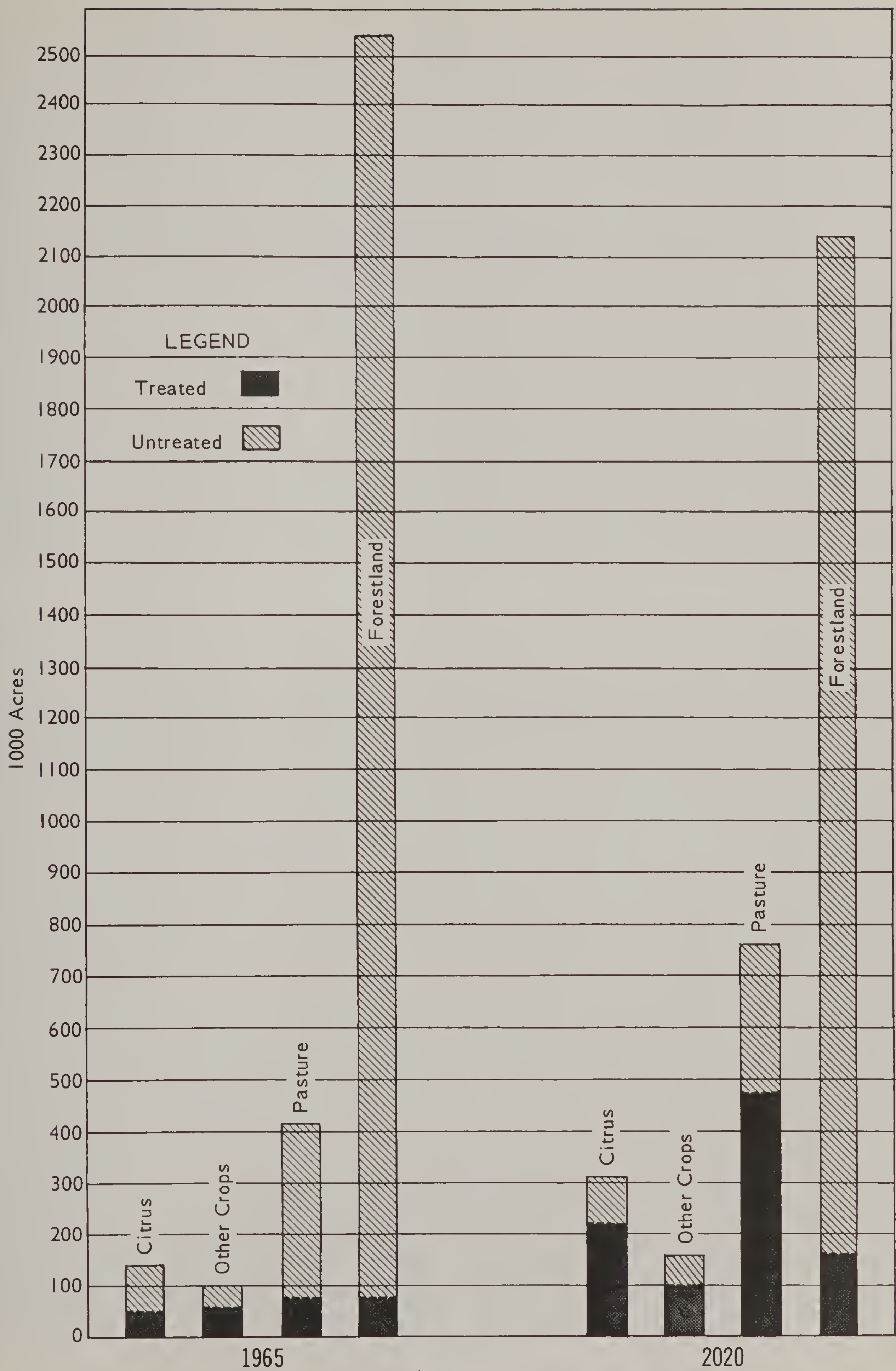

Figure 3–2

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U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA
USDA-SCS-FORT WORTH, TEX. 1969

Courtesy Florida Agricultural Extension Service

Flooding of Homesites and Pastureland

Figure 3-3

Courtesy Hudson Pulp & Paper Co.

Planting Sites Are Prepared by Bedding on Wet Soils
and Water Management on Forest Industry Land

Figure 3-4

Many of the lakes and streams of the Basin have water of suitable quality for irrigation. Some exceptions are those immediately adjacent to the coast, and the lower reaches of the St. Johns River. This river is subject to tidal salt water pollution in the middle and lower reaches. There are several salt water springs along the river that, during the periods of low flow, cause the salt concentration to be too high for agricultural use. Problems associated with the use of surface water for irrigation are intensified due to poor distribution (Figure 2-20) and to a lack of adequate storage in the streams and lakes. There are very few natural impoundment sites in the Basin and most of these are in areas of little or no demand for irrigation water.

Groundwater is the principal source of irrigation water and, if irrigation needs are to be satisfied, it is projected to remain the largest supplier in the future (Table 3.1). There are large quantities of good quality groundwater in the Basin but the water is not evenly distributed and there are areas where the groundwater supply has been depleted to dangerously low levels. Quality of the water in the Floridan Aquifer often tends to diminish with increasing depths and in areas of heaviest withdrawal. With greater water needs projected for future years by both agricultural and nonagricultural enterprises, the problem of poor quality groundwater will be greatly magnified.

TABLE 3.1 - 1965 Use and Projected Need for Irrigation Water From Groundwater Sources

County	1965		2020	
	1000 Ac.Ft.	% From Ground Water	1000 Ac.Ft.	% From Ground Water
Alachua	.7	20	2.7	55
Brevard	46.2	100	173.0	57
Clay	4.0	95	12.8	80
Flagler	7.6	100	27.3	90
Indian River	124.6	100	199.6	20
Lake	57.8	40	241.8	65
Levy	Less than .1	-	10.0	75
Marion	20.8	65	105.4	75
Okeechobee	3.4	50	37.5	90
Orange	42.3	75	42.0	60
Osceola	2.3	90	61.3	80
Polk	15.9	95	17.3	95
Putnam	12.2	95	29.9	75
Seminole	11.3	70	52.4	80
St. Johns	14.1	100	21.8	100
St. Lucie	48.4	100	90.2	20
Volusia	7.1	65	26.8	80
Total	418.7	84	1151.8	58

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The chloride and sulphate concentrations of the water in the Upper Floridan Aquifer (Figures 3-7 & 3-8) are two contaminants which appear to have the greatest effect on irrigation water quality. It is generally accepted that 500 parts per million of chlorides can have adverse effects on crops with low salt tolerance such as citrus. During prolonged droughts, chlorides from irrigation water tend to accumulate in the soil, thereby intensifying the problem. Sulfur in the form of sulfides has recently been found to have an even greater damaging effect on citrus feeder roots under certain conditions than salt. (Sunshine State Agricultural Research Report, Vol. 12 - No. 2).

Range and Forest Fires

In 1965, 1443 wild fires burned 17,550 acres of forestland. Two of the 19 counties - 7 percent of the area - are without cooperative fire protection. Over 30 percent of the forestland in unprotected areas suffers damage from wildfire annually, compared to less than 1 percent in areas having cooperative fire protection. This is partly due to the satisfactory job of prescribed burning in counties having fire protection, using trained fire control personnel and equipment.

Other Forestry Problems

The large acreage (1,986,500 acres) of forestland in farm and miscellaneous private ownerships presents a management problem. Many of these owners are apathetic toward growing trees or improving existing timber stands on portions of their land well suited for this use. Some fail to realize the possibility of supplementing their income by growing timber products with the added opportunities for providing watershed protection, income producing recreation, forage and wildlife. Often they cannot afford the costs of replanting a stand or doing the necessary timber stand improvement. High forestland prices, due to speculative possibilities, make the purchase of land for the purpose of growing timber unattractive. Both authorized and unauthorized users of forestland often damage timber, roads, and other improvements, or molest livestock. Posting and patrolling forestland to prevent trespassing is expensive and may cause public relations problems for the owners.

Recreation and Wildlife

Increasing pressures for the use of land and water resources for various purposes will continue and accelerate in the future. Recreational and wildlife areas will be subject to these pressures, and at the same time be affected by increases in population which will demand more facilities and space for outdoor recreation. Planners are confronted with very real problems in attempting to set aside areas to help meet the demand for land and water oriented recreation and wildlife habitat.

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Lakes Provide Water For Multiple Uses

Figure 3-5

Groundwater for Irrigation

Figure 3-6

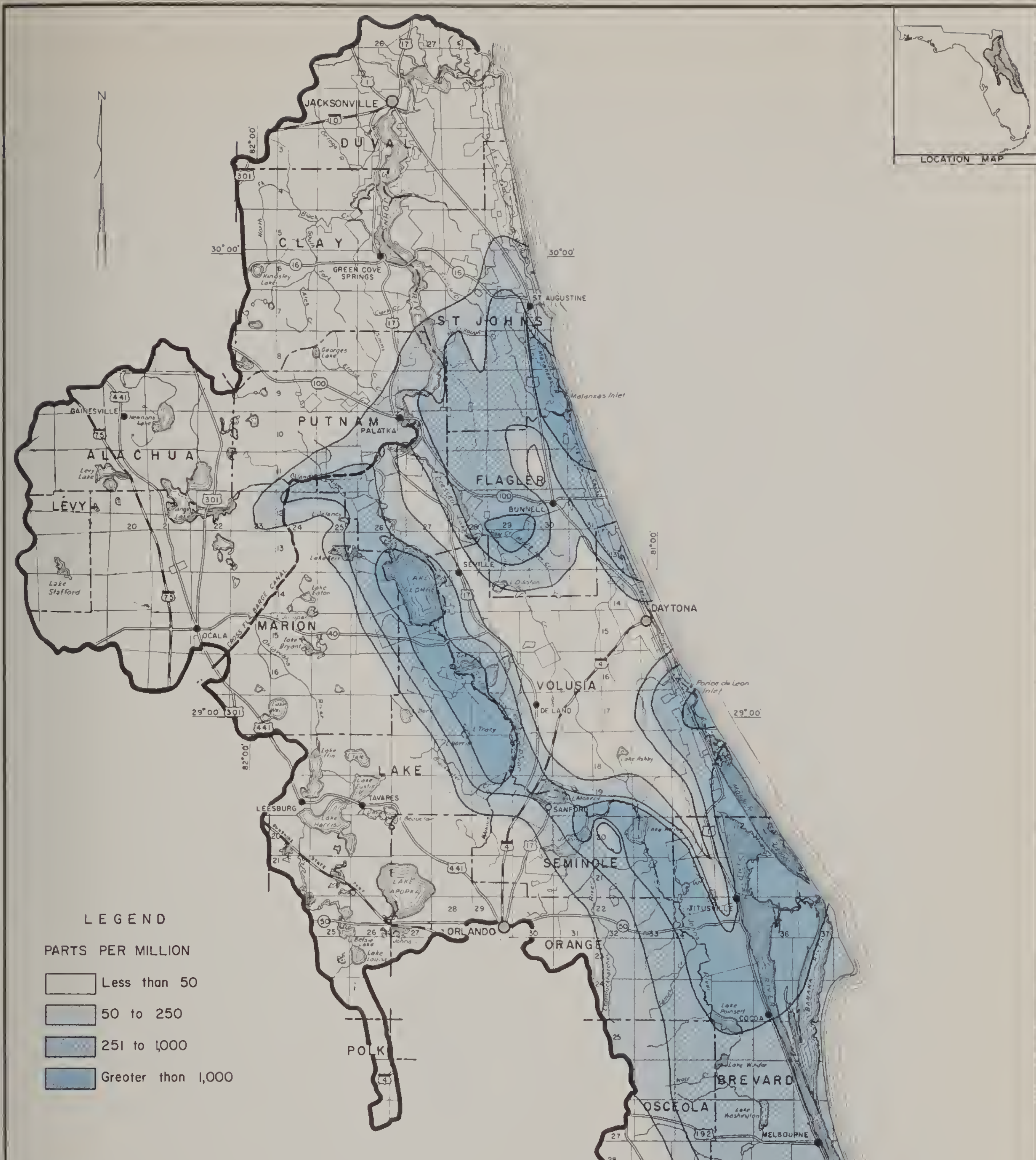

Figure 3-7

CHLORIDE CONCENTRATION IN WATER FROM THE UPPER PART OF THE FLORIDAN AQUIFER*

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

* USGS MAP SERIES NO. 12 MAY 1965

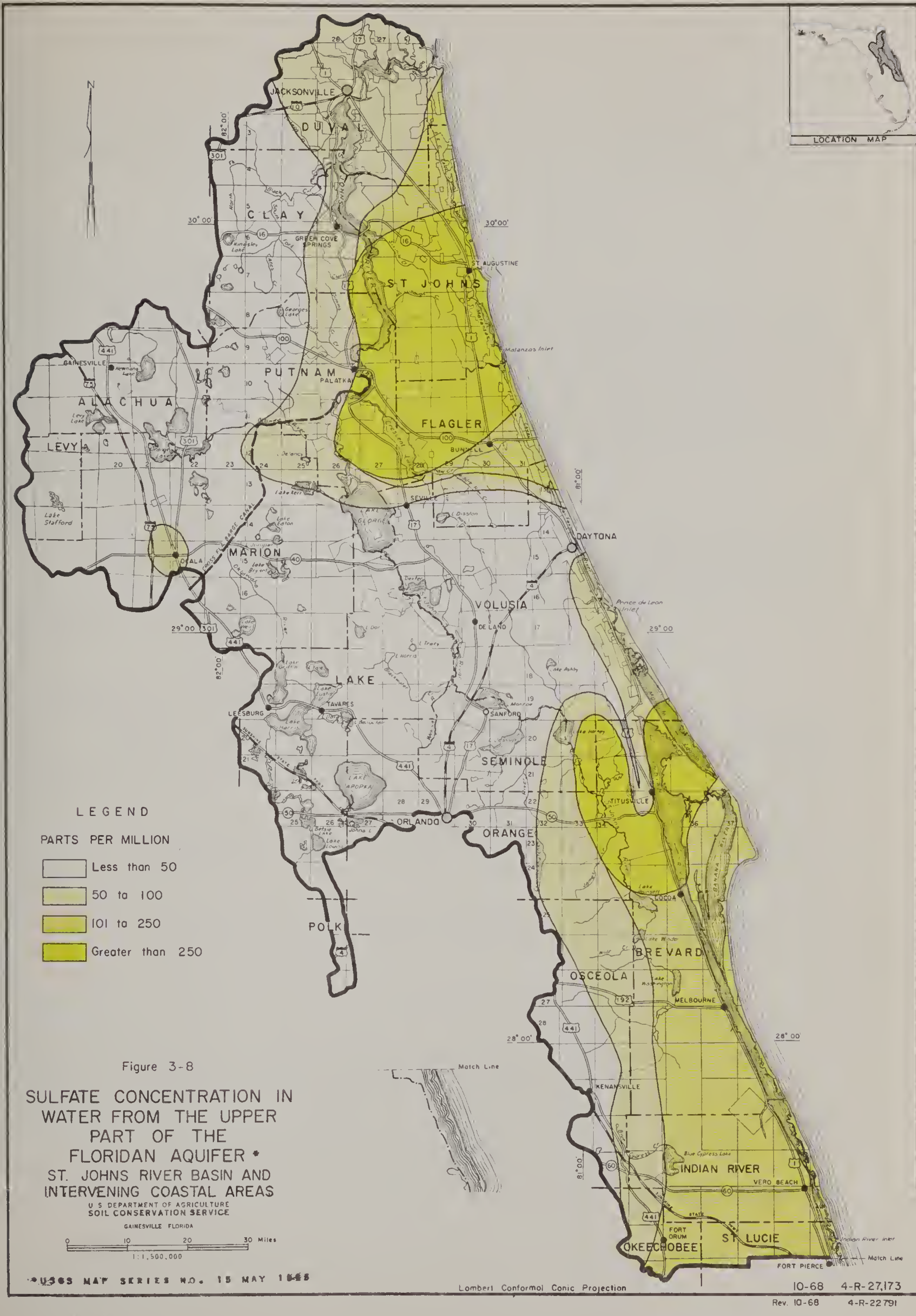

Figure 3-8

SULFATE CONCENTRATION IN WATER FROM THE UPPER PART OF THE FLORIDAN AQUIFER *
ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

SECTION IV

PRESENT AND FUTURE NEEDS FOR WATER AND RELATED LAND RESOURCE DEVELOPMENT

Future Product Requirements

Approach and Limitations

The preparation of plans for management and development of land and water resources requires the adoption of a set of basic economic assumptions and projections. The assumptions and projections concerning the national economy used in this study are those suggested for uniform use among the several federal agencies engaged in resource planning. Under the adopted criteria, satisfying the needs of the population for goods and services becomes the objective of the planning procedure.

National commodity requirements served as a guide in determining Florida's anticipated production needs. The term "production needs", as used in this report, refers to the amount of production Florida would normally be expected to contribute toward fulfilling national product requirements.

Economic Guidelines

Needs presented in this study are based upon the following conditions which are generally accepted by the various agencies engaged in resource planning:

1. An international scene marked by no widespread outbreak of hostilities and with sufficient economic and political stability to permit an upward trend in international trade.

2. A domestic scene marked by no major depression and by continuing economic progress under existing economic and political systems.

3. A stable general price relationship.

4. Federal - nonfederal cooperation to encourage economic progress for all segments of society.

5. Progress in education, training, technology, capital accumulation, and resource development.

6. Reduction of institutional barriers to economic progress.

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7. Production of goods and services in accordance with effective demand at satisfactory levels of returns to producers and at projected price levels.

8. Constant per capita utilization of agricultural products in the United States beyond 1980.

9. That current and projected trends in regional and area production patterns reflect the comparative advantage of competing areas.

10. That the decisions of producers concerning physical and economic feasibility and profitableness of alternative uses of resources reflect their evaluation of comparative advantage including limitations in the availability of land, water, labor, management, and capital.

Projected national population and per capita utilization of commodities are key parameters in estimating future product needs. These as well as other components of the national economic framework drawn from an Office of Business Economics - Economic Research Service study are presented in Table 4.1. United States population estimates are based on Series B estimates of the Bureau of the Census. The series B level of population assumes a national annual growth rate of 1.6 percent, or a moderate decline from the 1962-1965 growth rate. No change in per capita demand is shown after 1980. Thus, increases in total product demand after 1980 reflect essentially the influence of a growing population.

Commodity Requirements - Basin

Future commodity needs are compared with 1965 production in Table 4.2. With the exception of pork, the level of production of all farm commodities will have to be increased considerably to meet anticipated requirements. The need for citrus and dairy products is expected to be twice the 1965 level by 1980. Beef and poultry needs are also increasing quite rapidly as a result of rising population, increased disposable incomes, and projected higher per capita utilization of livestock products. Hay production has grown rapidly in recent years; however, current production is only a small share of future needs. More and more beef and dairy products are being produced in feed lots with limited grazing. Leaders in the industry anticipate this trend toward intensified production will continue; hence, hay and feed grain production will become increasingly important.

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TABLE 4.1 - Selected Components of the National Economic Framework, United States, 1960 with Projections to 2020

Item	Unit	1960	Projected 1980	Projected 2000	Projected 2020
Population 1/	Mil.	180.7	245.3	338.2	469.1
Employment	Mil.	66.4	94.8	130.6	181.2
Gross national product	Bil.dol. 2/	440	1001	2144	4686
Personal income	Bil.dol.	352	785	1680	3630
Per capita income	Dollars	1955	3200	4967	7738
Per capita utilization:					
Citrus	Lb.	84	102	102	102
Veg. & melons (farm wt.)	Lb.	203	259	259	259
Potatoes	Lb.	149	143	143	143
Beef (liveweight)	Lb.	171	194	194	194
Pork (liveweight)	Lb.	94	98	98	98
Poultry (liveweight)	Lb.	57	64	64	64
Eggs	No.	338	308	308	308
Dairy products	Lb.	645	593	593	593
Wood products	Cu.ft.	65.9 3/	65	67.5	54.7

1/ Bureau of the Census, Series B level of growth
2/ All income is in 1954 dollars
3/ 1965 Data

TABLE 4.2 - Farm Production, St. Johns River Basin, 1965 & Projected Needs

Item	Unit	1965 Production	Projected product needs 1980	Projected product needs 2000	Projected product needs 2020
Crops					
Oranges	Mil.bx.	36.3	70	95	130
Grapefruit	Mil.bx.	12.3	25	40	55
Tangerines	Mil.bx.	1.8	2.6	3	4
Veg. & melons					
Fresh	Mil.lb.	393	630	880	1140
Processed	Mil.lb.	86	135	195	250
Potatoes	Mil.lb.	423	725	1010	1300
Corn	Thou.bu.	280	440	555	690
Peanuts	Mil.lb.	2.3	4.0	5.5	7.6
All hay	Thou.tn.	35	65	115	180
Livestock					
Beef & veal	Mil.lb.	81	160	260	420
Pork	Mil.lb.	10	6.5	8	11
Milk	Mil.lb.	210	460	670	875
Eggs	Mil.	360	490	730	950
Poultry	Mil.lb.	19	36	50	70
Wood products	Mil.cu.ft.	62.5	71	129	165

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Estimates of needs are not intended to specify the actual level of farm output in any of the three target years. Rather, the figures indicate the level of output the study area needs to supply in order to maintain its competitive position in relation to other supply areas. In reality, the actual level may differ greatly from needed output leaving a net deficit or surplus condition. For most commodities, Florida will remain a net import area. Proper planning to meet future irrigation needs and to provide adequate drainage and flood protection of agricultural lands is essential if the area is to maintain or increase its contribution to national production.

Forest Product Requirements

By 1980, the production of logs for lumber, veneer, plywood and miscellaneous products is expected to increase about 17 percent over the 1965 level. The production of these products is expected to be 100 percent above the present level by 2000 and make a slight increase between 2000 and 2020. By 1980, the production of pulpwood is expected to increase by one-half over the 1965 level, be two and one-half times the present level by 2000, and reach nearly three times the 1965 production by 2020. The increased demand for fireplace wood can be expected to stimulate fuelwood production which has been declining in recent years. Naval stores from steam distillation and gum are expected to decrease and the production of tall oil rosin to increase.

To meet the increasing demands for wood products, the present annual cut from growing stock is projected to increase from the present rate of 56.7 million cubic feet to 71.2 million cubic feet by 1980. By 2000, it is expected to reach 129.2 million cubic feet, and 165.4 million cubic feet by 2020.

Under the present level of forest management, net annual growth of growing stock is projected to increase from 73.2 million cubic feet in 1965 to 77.3 million cubic feet by 1980, decrease to 63.0 million cubic feet by 2000, to 56.5 million cubic feet by 2020. The resulting cut-growth relationship will reduce the volume of growing stock and annual growth each year. Figure 4-2 shows the projected cut, growth and inventory of growing stock, by time frames, under the present level of forest management.

In 1965, 77 percent of the net annual growth of the growing stock was harvested. The present level of forest management will not maintain this cut-growth ratio. The annual growth needed to meet these requirements and the estimated production for 1980, 2000 and 2020 are shown in the following chart.

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Courtesy U. S. Forest Service

Courtesy U. S. Forest Service

Pulpwood is a Product of Increasing Importance

Figure 4-1

PRESENT AND PROJECTED CUT, GROWTH, AND INVENTORY OF GROWING STOCK UNDER THE PRESENT LEVEL OF FOREST MANAGEMENT

St. Johns River Basin and Intervening Coastal Areas

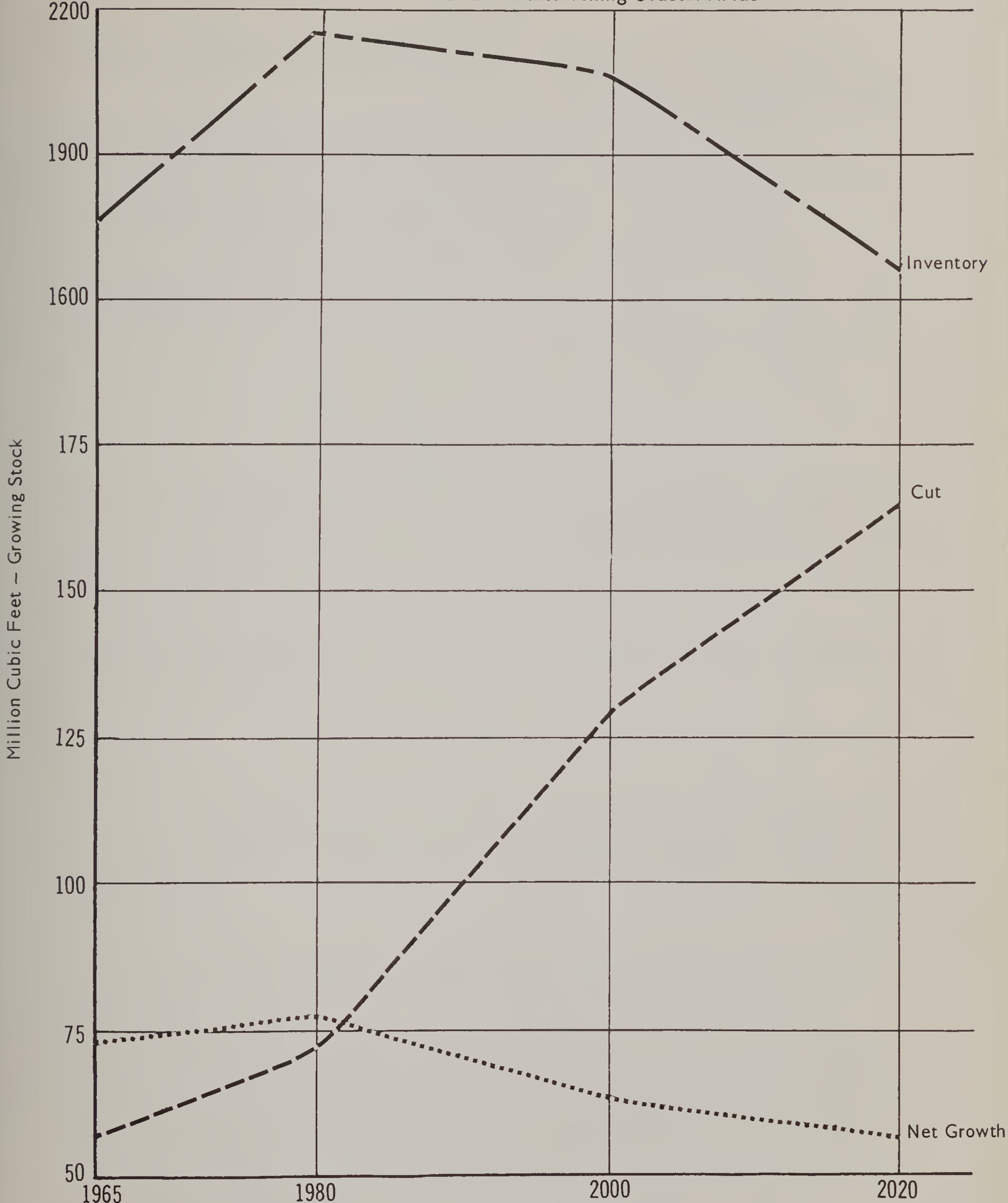

Figure 4–2

4–27090 9–68

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA

USDA-SCS-FORT WORTH, TEX. 1969

Annual Growth Needs - Growing Stock

	Year 1980	2000	2020
Annual growth needed to maintain present cut-growth ratio. (Million cubic feet)	92	167	214
Annual growth per acre needed to maintain present cut-growth balance (cubic feet)	28	55	77
Production of wood products (Million cubic feet)	71	129	165

Projected Agricultural Land Use

Land use projections are compatible with the capabilities of the Basin's soil resources. This is important in the selection and treatment of suitable land to provide for the orderly expansion of use of the land and water resources to help meet the needs of a rapidly growing population.

Problems associated with soil limitations, erosion, and excess water were considered in projecting acres of land needed to produce agricultural and forest products.

Land Needs

Forces inherent in economic growth are reducing the land area available for agricultural use. Notable examples in the Basin include highway and airport construction, development of shopping centers, golf courses, and expansion of residential areas in line with population growth.

The projected increases in areas of fresh water and for non-agricultural uses, indicate a reduction of approximately 935,000 acres in the area devoted to agriculture by 2020. This loss of agricultural lands to other uses and the projected increases in demand for agricultural and forest products will bring about substantial changes in land use within the agricultural sector. These increases in demand will be met in part by improved technology and more efficient operations. In addition, a greater portion of the agricultural area will be utilized more intensively for crop production and improved pasture, the location of which will tend to shift to the more productive soils at the expense of rangeland and forestland (Figure 4-3).

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It is expected that the loss of agricultural area to other uses will affect all agricultural and forestry enterprises and will occur in all land capability classes. New plantings will be necessary to recover losses to other uses, as well as to obtain increases necessary to reach the projected 2020 acreage requirement (Table 4.3). Indications are that these new plantings will require additional areas in excess of 189,000 acres for citrus, 28,000 acres for vegetables, 21,000 acres for other crops, and 449,000 acres for improved pasture. No significant changes in the actual cropping pattern are anticipated other than a continued shifting of citrus acreage toward the southern portion of the Basin.

TABLE 4.3 - Major Agricultural Uses of Land - 1965 & Projected (Acres)

	1965	1980	2000	2020
Citrus	357,200	400,800	459,600	546,400
Vegetables1/	68,700	86,200	91,600	97,200
Other Crops	107,500	103,200	115,000	129,000
Improved Pasture	634,700	789,500	920,200	1,084,100
Unimproved Pasture	707,200	492,300	242,700	69,700
Forestland	3,514,500	3,260,200	3,043,800	2,772,600
Miscellaneous Uses	515,800	415,700	333,300	271,000
Total	5,905,600	5,547,900	5,206,200	4,970,000

The trend toward efficiencies in production, resulting from competitive market and price situations; increased knowledge of soil capabilities as related to crop production; better control of soil borne diseases, permitting the use of a given area for longer periods of time for a specific crop; and other factors, all contribute to the shifting of agricultural uses to available soils of best suitability. This does not eliminate the fact that soil and water problems will continue to exist in varying degrees of severity.

Selected areas suitable for recreation and for wildlife purposes were classified as reserve areas and their acreage removed from the agricultural base for each time frame. In selecting a reserve area, the needs for water oriented recreation and the distance of the area from centers of population were among the factors considered.

1/ Includes potatoes and melons

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MAJOR USES OF AGRICULTURAL LAND

St. Johns River Basin and Intervening Coastal Areas

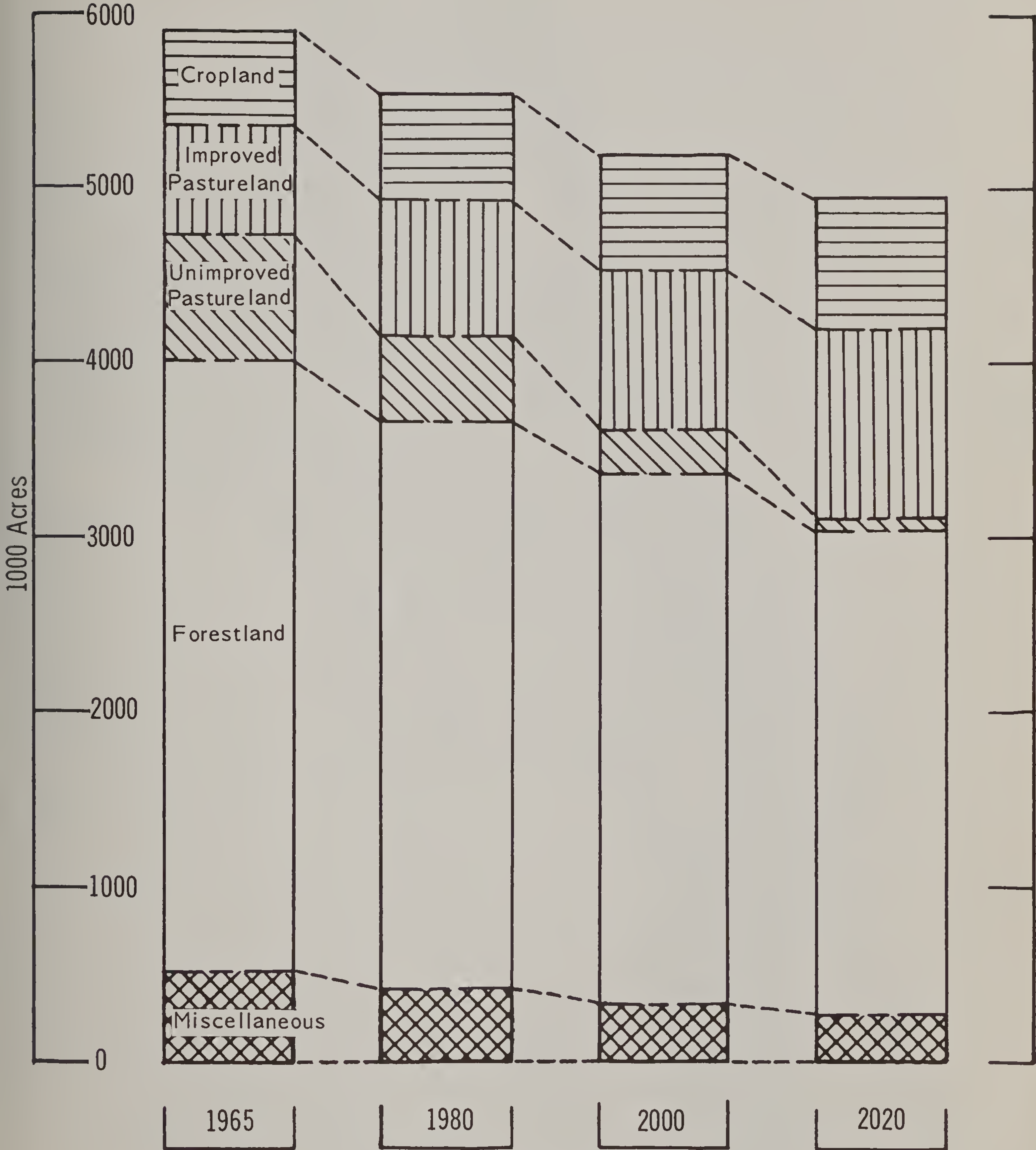

Figure 4–3

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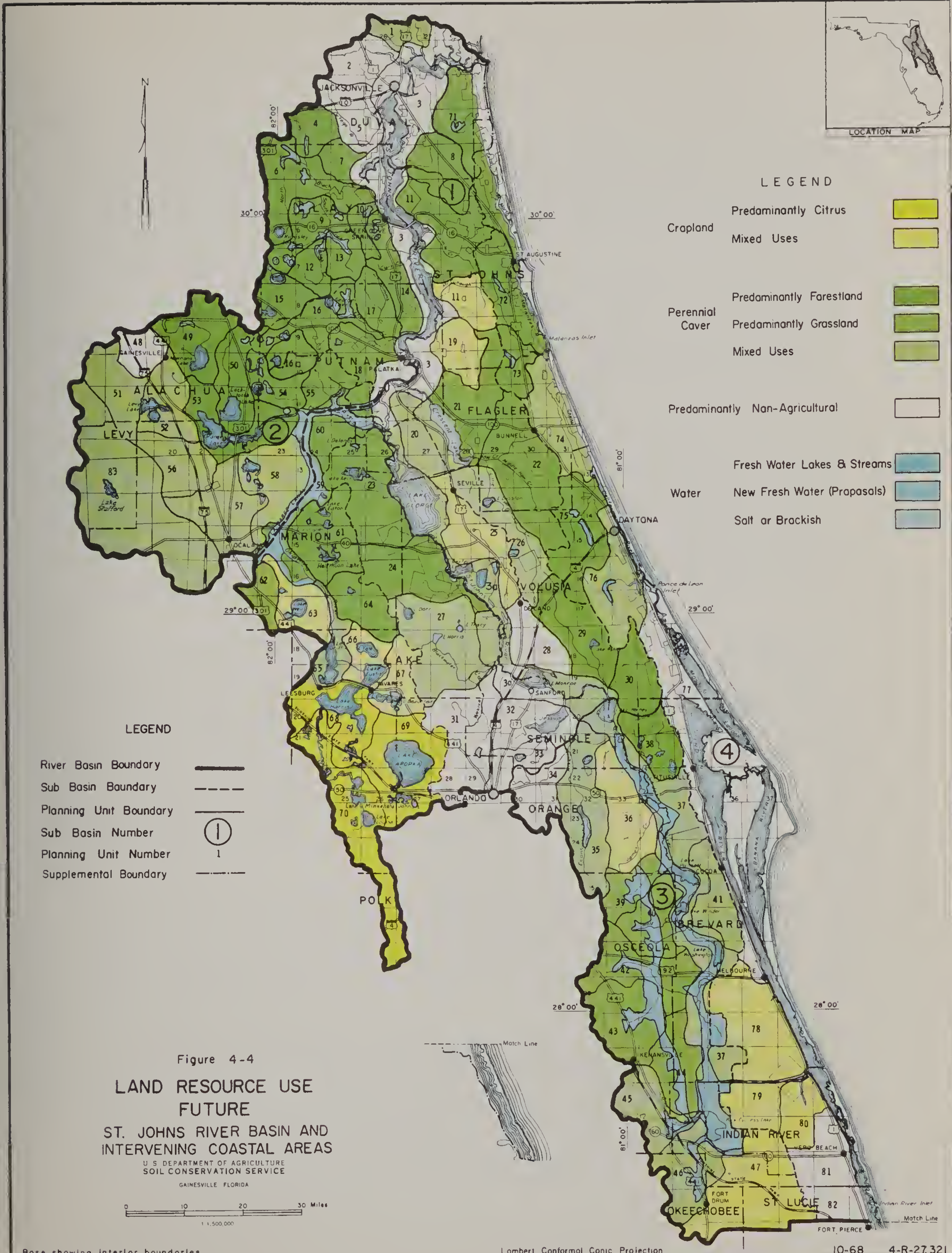

Figure 4-4

LAND RESOURCE USE
FUTURE

ST. JOHNS RIVER BASIN AND
INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

Base showing interior boundaries. Lambert Conformal Conic Projection 10-68 4-R-27,321

Formerly 2-P-10.999 Rev. 10-68 4-R-21,663

The use of forestland for grazing is expected to continue, but become more confined to definite areas under more intensive management. It is believed that most of this grazing will be on pine plantations during the latter two-thirds of the time required for a pulpwood rotation.

Projected Agricultural Water Use

The projected water requirements for agriculture by the years 1980, 2000, and 2020 were computed and summarized in the same manner as for present agricultural water requirements.

The percentages of the total acres in citrus, truck crops, and pasture that are projected to be irrigated in the future were based on 1965 inventory data adjusted for future acreage projections and trends in irrigation participation. Commercial truck crops, most of which were irrigated in 1965, are expected to be entirely under irrigation in the future. Irrigated pasture is expected to increase from about 5 percent of the total improved pasture in 1965 to 20 percent by 2020.

It is estimated that 84 percent of the total citrus acreage in 2020 will be irrigated. All groves in the Indian River area are expected to be irrigated as a normal management practice since the citrus in this area is shallow rooted and cannot tolerate extended droughts without severe damage. Some of the citrus on upland or "ridge" areas are not expected to be irrigated even in the future.

Table 4.4 shows the breakdown by counties of the projected 2020 irrigated acreage by crop and source of water. Table 4.5 gives similar data but in acre-feet of water rather than in acres.

The projected irrigation needs from groundwater supplies were the result of a determination of total irrigation needs, less the amount that could be met by existing and proposed surface supplies. Should proposals for additional surface storage not materialize, then a greater portion of the needs, if met, would have to come from underground supplies.

Figure 4-5 presents the projected 2020 total agricultural water needs by counties. These data are shown as the depth in inches over the entire county. Figure 4-6 indicates the 1965 and the projected 2020 water requirement for rural domestic purposes, livestock, and golf courses. These requirements, added to the irrigation water needs, result in a total projected water requirement by agriculture that is of major importance.

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The Basin's average annual runoff is approximately 12 inches per year. For certain planning units, this is approximately the projected need for agriculture by 2020, not considering municipal and industrial requirements. Storage of all the normal runoff from these areas of greatest demand would not satisfy projected needs. Water could be made available from nearby planning units to meet much of this need through a system of storage areas, pumps, and associated channels. Projections do not indicate a Basin-wide shortage of water but the problem will be one of management to transfer water from surplus to deficit areas.

TABLE 4.4 - Projected Irrigation Needs - By 2020 - (1000 Acres)

County	Citrus		Pasture		Truck	
	Wells	Surface	Wells	Surface	Wells	Surface
Alachua	0.2	0.1	-	-	2.2	2.2
Brevard	22.9	17.3	23.6	17.8	3.9	2.9
Clay	-	-	4.1	1.0	0.6	-
Flagler	-	-	7.5	1.3	11.5	-
Indian River	18.0	72.0	4.7	18.9	1.5	5.8
Lake	76.9	46.0	7.5	2.3	3.2	6.7
Levy	-	-	3.0	1.0	0.4	-
Marion	14.5	4.5	20.0	5.4	14.0	6.6
Okeechobee	5.2	2.0	10.5	-	2.0	-
Orange	15.0	2.7	1.0	-	2.0	18.0
Osceola	3.8	1.2	18.0	4.0	-	-
Polk	9.3	0.7	-	-	-	-
Putnam	1.5	1.0	6.2	2.2	10.0	-
Seminole	10.5	4.5	6.5	1.0	16.4	-
St. Johns	0.1	-	2.1	-	32.9	-
St. Lucie	8.1	32.3	1.9	7.6	1.2	4.8
Volusia	2.8	1.6	6.1	1.1	2.9	-
Total	188.8	185.9	122.7	63.6	104.7	47.0

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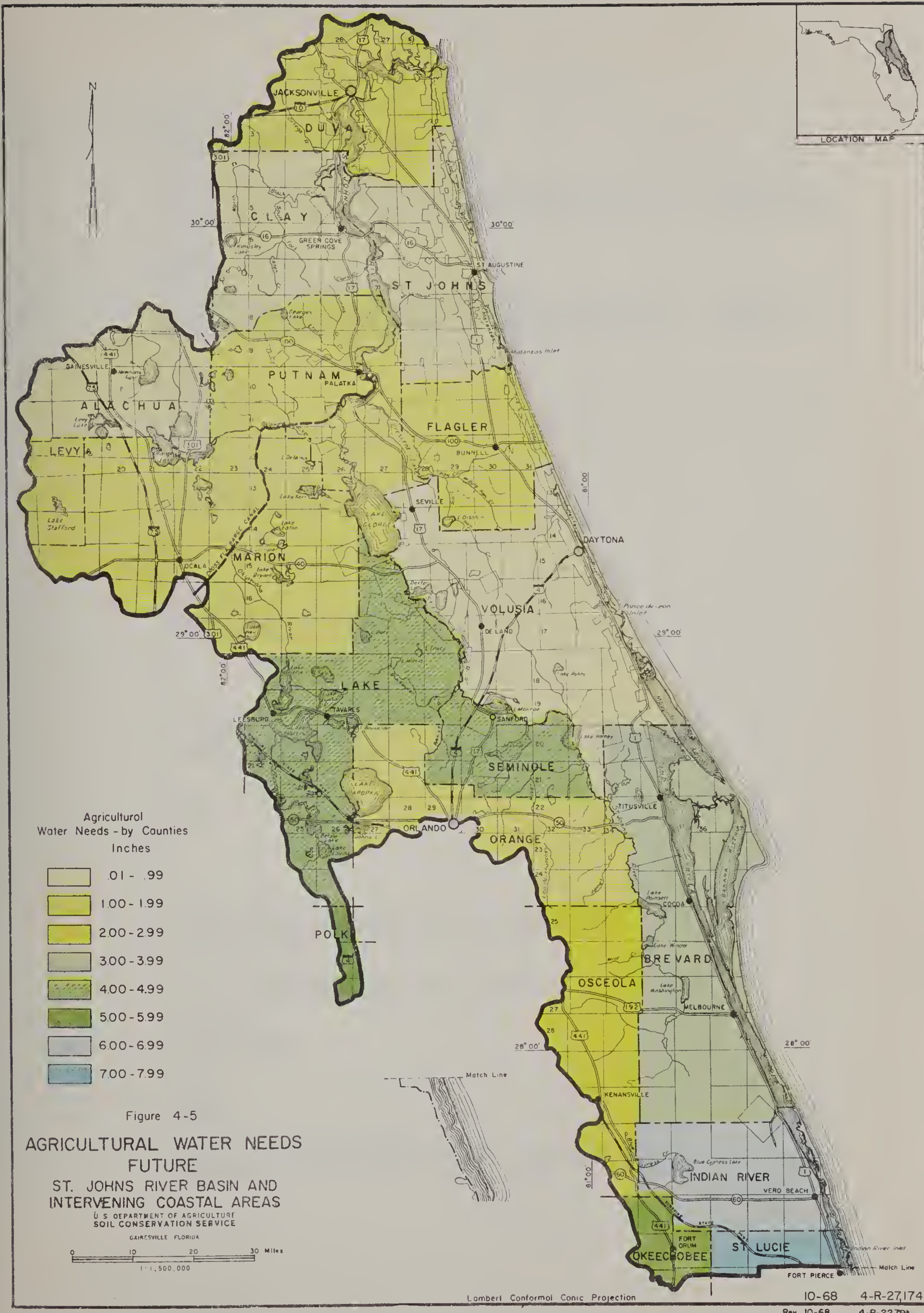

Figure 4-5

AGRICULTURAL WATER NEEDS FUTURE

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

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GAINESVILLE FLORIDA

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WATER USE FOR RURAL, DOMESTIC, LIVESTOCK AND GOLF COURSES

St. Johns River Basin and Intervening Coastal Areas

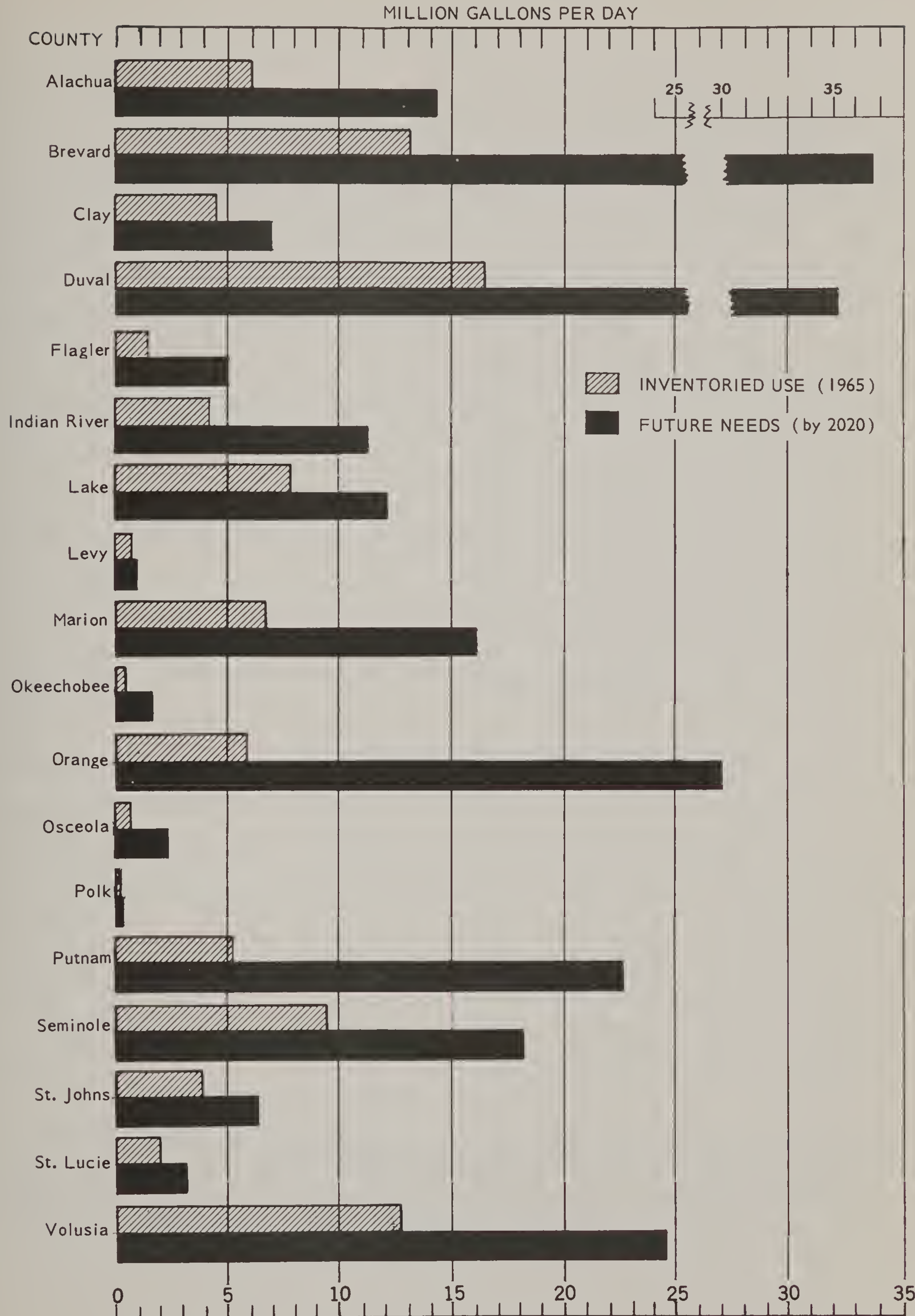

Figure 4–6

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TABLE 4.5 - Projected Irrigation Needs - By 2020 (1000 Acre-feet)

County	Citrus		Pasture		Truck	
	Wells	Surface	Wells	Surface	Wells	Surface
Alachua	0.4	0.2	-	-	1.1	1.1
Brevard	38.9	29.3	54.8	46.6	1.9	1.5
Clay	-	-	10.0	2.5	0.3	-
Flagler	-	-	18.4	3.2	5.7	-
Indian River	27.6	110.6	11.6	46.3	0.7	3.0
Lake	133.0	79.6	18.6	5.6	1.6	3.4
Levy	-	-	7.4	2.5	0.2	-
Marion	25.1	7.8	49.0	13.2	7.0	3.3
Okeechobee	7.8	3.0	25.7	-	1.0	-
Orange	24.8	4.7	2.5	-	1.0	9.0
Osceola	5.7	1.8	44.0	9.8	-	-
Polk	16.1	1.2	-	-	-	-
Putnam	2.6	1.7	15.2	5.4	5.0	-
Seminole	18.7	7.3	15.8	2.5	8.2	-
St. Johns	0.2	-	5.1	-	16.5	-
St. Lucie	12.8	51.1	4.7	18.7	0.6	2.4
Volusia	4.8	2.8	15.0	2.7	1.5	-
Total	318.5	301.1	297.8	159.0	52.3	23.7

Pulpmills can be expected to expand their operations and increase annual production. It is anticipated that they will develop more efficient methods of pulping and re-using water, enabling them to increase production without increasing their water use.

ACRES IRRIGATED

St. Johns River Basin and Intervening Coastal Areas

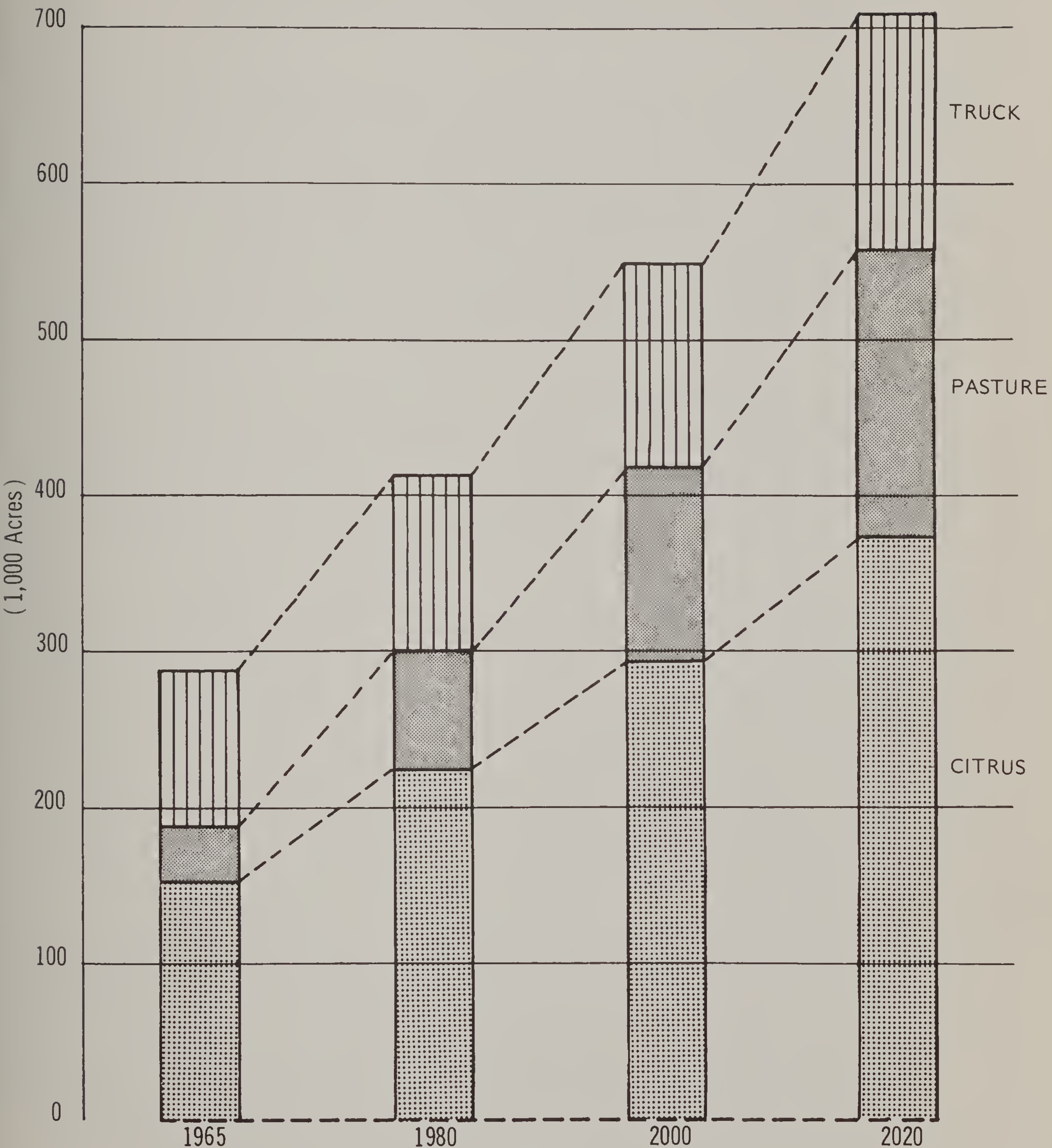

Figure 4–7

4–27090 9–68
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SECTION V

EXISTING WATER AND RELATED LAND RESOURCE PROJECTS AND PROGRAMS

Status of Water and Related Land Resource Programs

Several Federal, State and local government agencies are actively engaged in soil and water resource development programs. The Soil Conservation Service, through the Small Watersheds Program (Public Law 566), has one project under construction, two authorized for construction operations, one application awaiting planning authority, and four projects currently in the planning stage. In addition to its P.L. 566 activities, the Soil Conservation Service provides technical assistance to individual farmers and ranchers through the P.L. 46 Conservation Operations Program. The entire Basin is covered by soil and water conservation districts.

Other U.S.D.A. agencies which participate in soil and water resource development are the Agricultural Stabilization and Conservation Service through its cost-share program for needed conservation measures, the Farmers Home Administration, through its soil and water conservation loan program, and the Rural Electrification Administration through its rural electrification loan program.

The 430,349 acre Ocala National Forest, 361,438 acres of which is in Federal ownership, is located in the Basin. The Forest Service, U. S. Department of Agriculture, manages the National Forest lands for outdoor recreation, range, timber, watershed, and wildlife and fish. The Forest Service also assists the State of Florida through cooperative programs of forest fire control, forest pest control, advisory management, flood prevention and river basin studies, forest management, utilization, and marketing. The Florida Forest Service is responsible for fire protection on land outside the National Forest, and for furnishing technical assistance to woodland owners. The Extension Service and soil and water conservation districts include technical assistance as one of their services to woodland owners.

The Florida Agricultural Experiment Station of the University of Florida has active soil and water research projects to determine the effects of different land treatment measures on production of agricultural crops and timber.

Presently underway, and involving several Federal and State agricultural agencies, is the updating and revision of the Conservation Needs Inventory. That portion of the inventory concerned with the St. Johns Basin was coordinated with data obtained for development of the Basin report.

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Activities of the U.S. Army Corps of Engineers are widespread.[1/] Projects of this agency are in various stages of planning and development. Among the major works underway at the present time are: (1) the Cross-Florida Barge Canal which will connect the St. Johns River with the Florida West Coast through a system of five locks; (2) the Upper St. Johns Project (a portion of the Central and Southern Florida Flood Control District) comprising an intricate system of canals, levees and pumps designed for removal of floodwater as well as for storage of water for beneficial use, and for navigation; (3) the Intra-Coastal Waterway which extends the length of the Basin along the Atlantic Coast; (4) the Oklawaha River, which is included in the authorization for the Four River Basins Project; (5) Flood Plain Information Studies of the St. Johns River Basin, and (6) an emergency flood control study of Hogtown Creek in the City of Gainesville.

The Central and Southern Florida Flood Control District is the local organization established by the Florida Legislature to represent local interests and to provide for the operation and maintenance of the authorized Central and Southern Florida Flood Control Project, in which the Upper St. Johns Project is located. The Southwest Florida Water Management District has similar responsibility on the authorized Four River Basins Project, of which the upper reaches of the Oklawaha River are a part.

The U. S. Geological Survey, in cooperation with State and local agencies has groundwater studies either completed or underway in several counties. The U.S.G.S. also compiles information and keeps streamflow and lake elevation records on the major streams and lakes.

The East Central Florida Regional Planning Council is a legally constituted advisory body serving seven Florida counties. It acts in an advisory capacity to the constituent local governments in planning and zoning matters involving land use, water resources, and construction of highways and facilities. Advanced planning is vital in this area most directly affected by the rapid growth and development resulting from space explorations at Cape Kennedy.

1/ More detailed information on the Corps of Engineers projects is included in the publication "Water Resources Development by the U. S. Army Corps of Engineers in Florida".

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United States Department of Agriculture Projects and Programs

Land Treatment Programs

The Soil Conservation Service, through its soil and water conservation program authorized by Public Law 46, cooperates with local groups and governing bodies, such as soil and water conservation districts, water conservation and management districts, and county commissions as well as with other federal agencies in the development and implementation of soil and water conservation programs. These programs serve individual, private, and public interests in the protection, use and improvement of soil and water resources, for the sustained production of agricultural commodities and for the preservation and improvement of recreation and wildlife resources. A portion of this program is devoted to the procurement of essential data through soil surveys and to the interpretation of these data for non-agricultural as well as for agricultural purposes.

The Agricultural Conservation Program (ACP), was authorized by the Soil Conservation and Domestic Allotment Act of 1936 and amended in 1937 to furnish cost-sharing assistance to farmers and ranchers in carrying out needed soil, water, forestland, and wildlife conservation practices on their land.

The program is reviewed annually and adjustments are made as necessary to meet changing conservation needs. Each year's State program is formulated by the State ACP Development Group to include those practices in the national program to meet the State's conservation problems. The Agricultural Stabilization and Conservation Service State Committee, the Soil Conservation Service, the U. S. Forest Service and other federal and state agencies and organizations with conservation interests, participate in the development of the State program.

This service is furnished in all counties and the cost-share earned in the counties represented in the Basin amounted to over $700,000 for the 1966 fiscal year. There were nearly 2400 farms that applied one or more of the following conservation measures:

(1) Establishing permanent cover of grasses and legumes

(2) Improving permanent cover of grasses and legumes

(3) Installing permanent open and closed drainage systems - conserving and disposing of excess water and preventing erosion

(4) Establishing temporary cover crops for protection from erosion

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(5) Establishing and improving farm forests

(6) Establishing conservation practices of primary benefit to wildlife.

The Agricultural Conservation Program for 1965 included three practices having a bearing on forestry: (1) A-7, tree planting for forestry, (2) A-8, tree planting to prevent erosion and (3) B-10, timber stand improvement. Practice A-7 was participated in by 12 counties in the Basin resulting in the planting of 1356 acres and cost-shares earned of $12,245. Four counties used practice B-10, treating 783 acres with cost-shares earned of $719. Practice A-8 was not used by any of the counties in the Basin.

In Putnam County, 210 acres were planted to trees under the Soil Bank Program in 1965.

The Farmers Home Administration of the U. S. Department of Agriculture makes water development and soil conservation loans to eligible individual farmers and to groups of farmers and rural residents to develop water supply systems for irrigation, household, and livestock use; to install drainage systems on farmland, and to carry out soil conservation practices. Each loan is scheduled for repayment in accordance with the borrower's ability to repay, over a period not exceeding 40 years. In addition to loans to individuals and groups, loans are also made to local organizations to help finance projects and develop land and water resources in watersheds planned under authority of Public Law 566. Eligible local organizations include soil conservation districts, irrigation districts, drainage districts, and similar organizations which have authority under State law to construct, maintain, and operate works of improvement. These watershed loans are repayable over periods up to 50 years.

Water Management Projects

The Secretary of Agriculture is authorized to give technical and financial assistance to local organizations in planning and installing works of improvement for protecting and developing the land and water resources in watersheds through the Watershed Protection and Flood Prevention Act, as amended (Public Law 566). Each of these project areas is limited to a maximum size of 250,000 acres. The act also authorizes the Secretary to cooperate with other federal, state and local agencies in making investigations and surveys of watersheds or rivers and other waterways as a basis

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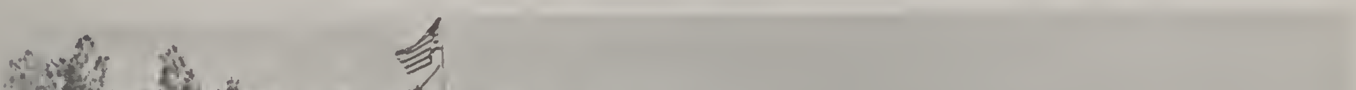
Courtesy Hudson Pulp & Paper Co.



Courtesy Florida Forest Service

Over Twenty-Million Pine Seedlings were Planted in 1965
and One of 14 Fire Control Headquarters

Figure 5-1

for the development of coordinated programs. The primary objective of USDA participation in river basin surveys is to facilitate the coordinated and orderly conservation, development, utilization, and management of water and related land resources. Programs formulated by USDA for these purposes will promote economic growth and development. Components of these programs will contribute to the satisfaction of current and long-term needs for resource utilization. USDA will use information developed in river basin surveys to coordinate its project type water and related land resource conservation and development programs with those of other federal, state and local agencies.

Cooperative Forestry Program

The cooperative programs of the U. S. Department of Agriculture Forest Service, provide assistance to state and private forestland owners for the protection and development of forest resources.

These programs include: (1) Cooperative Forest Management, (2) Forest Pest Control, and (3) Cooperative Forest Fire Control. Their objectives are to provide for increased timber needs, reduce losses from forest fires, insects and diseases, improve wildlife habitat, improve watershed conditions, and develop forest recreation opportunities.

The Cooperative Forest Management Program includes assistance with tree nursery production, tree planting, naval stores, research on direct seeding, and forest tree improvement. During 1965, over twenty million pine seedlings were planted, and twenty-two producers participated in the Naval Stores Conservation Program. The Florida Forest Service employs thirteen farm foresters in the Basin, partially provided for under the Cooperative Forest Management Program. These men give technical assistance to private forestland owners on problems of multiple use management, timber harvesting, utilization, marketing, prescribed burning, and control of insects and diseases. Special emphasis is placed on helping small land owners, the objective being to establish more productive forest management on all private forestland.

The Forest Pest Control Program provides financial and technical assistance through cooperative agreements for the protection of resources from insects and diseases on all forestland. Aerial observations are made periodically to detect infestations by insects and the occurrence of diseases. Ground checks are made of affected areas and the land owners notified of the condition.

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Assistance is provided under the Cooperative Fire Control Program, made possible by the Clark-McNary Act, which enables the Secretary of Agriculture to appropriate matching funds for fire protection to state and private lands through cooperative agreements with the state foresters. The Cooperative Forest Fire Control Program also includes technical assistance to state personnel in all phases of fire control, namely fire prevention, fire behavior, fire danger rating, damage appraisal, equipment development, and prescribed burning.

Seventeen of the 19 counties in the Basin have fire protection by local option. The present level of fire protection is adequate within the protected area for all forest resource uses. There are 56 lookout towers, 14 of which are used as the headquarters for county fire control units. Lookout towers are spaced approximately 15 miles apart furnishing adequate coverage for fire detection under normal conditions. (See Figure 5-2 for location of lookout towers). Modern equipment is used for communication and fire suppression by trained personnel.

National Forest Program

The Ocala National Forest has a gross acreage of 430,349 of which 361,438 acres are in federal ownership. It is managed to help meet continuing public needs for outdoor recreation, range, timber, watershed, and wildlife and fish.

With its vegetative cover, relatively level topography and porous, sandy soils having rapid infiltration rates, this forest serves as an excellent recharge area for groundwater. Drainage is for the most part subsurface and erosion and sedimentation are not problems. Several springs, including some of Florida's largest, are located within the forest as are many natural, sandy-bottomed lakes.

Outdoor recreation is one of the most important uses of the Ocala National Forest. During 1965, there were 1,738,000 recreation visits representing 1,500,000 visitor days[1/] of use. There are 655 acres of developed recreation sites, 638 acres of which are water-oriented. The population of large and small game animals and the abundance of good bass fishing waters attract many hunters and fishermen.

The grazing of livestock occurs in the southwest portion of the Forest and has very little overall effect on other resources. At present, eleven permittees graze 435 head of cattle for 4,225 animal months' use. It is estimated that sufficient forage is being produced to furnish nearly six times the present use without detrimental effects on other resources.

1/ A visitor day is 12 man-hours of use

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LOOKOUT TOWER LOCATION

St. Johns River Basin and Intervening Coastal Area

Figure 5–2

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About one-third of the visitor days use by recreationists is directly attributed to wildlife. The large deer herd and other species of game such as squirrel, turkey, quail and dove attract thousands of hunters. The management of the wildlife habitat is coordinated with timber management by modifying methods of timber cutting to achieve a balance between the optimum habitat for wildlife and maximum timber production. In wildlife management areas, two-thirds of the area needing stand regeneration is planted with pine, and cultural measures are applied to the stand remaining to increase its production of game food. Sand pine is clear cut in small blocks with subsequent cuttings being made every 5 to 10 years on adjoining areas. The openings in the forest cover that result from this practice are essential for deer, turkey, and quail. In addition, 13 wildlife food patches have been planted to improve the habitat. The present coordination between timber management practices and wildlife management alleviates problems with population and dispersion of wildlife.

Rare, endangered and unique non-game wildlife species such as the Florida Panther, Florida Manatee, Southern Bald Eagle, Florida Scrub Jay, Florida Sandhill Crane, and American Alligator are still present on the forest. A few Florida Black Bear also survive.

Twenty-eight million board feet of timber were harvested in 1965 by 12 timber operators, furnishing employment for 178 woods workers. Pulpwood, cut mostly from sand pine, accounted for 94 percent of the volume of timber harvested. Longleaf pine seedlings were planted on 720 acres, and 270 acres were planted with slash pine. Stand regeneration by direct seeding included 1,115 acres of sand pine and 1,005 acres of longleaf and slash pine. During timber cutting and timber stand improvement operations, flowering trees and shrubs are left to enhance the scenic beauty.

The present level of forest fire protection is satisfactory for all forest resources. During 1965, 38 forest fires burned only 522 acres of National Forest land. Rapidly increasing use of the forest for recreation and expanding subdivision developments on privately owned land within the forest cause ever increasing fire problems, necessitating continued intensive fire control. No forest tree diseases of any significance have been observed.

The predominant mineral interest is phosphate rock, and any mining of it will be done under federal regulations which will prevent pollution. There are no outstanding mineral rights held by former owners of National Forest land. Privately owned land

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within the National Forest is not eroding or causing pollution on adjacent land or downstream areas.

The water resources, outdoor recreation, range, timber and wildlife and fish furnished by the Ocala National Forest, provide a desirable combination of opportunities resulting from proper use, treatment, development and management of forestland.

Forest Research Program

Information obtained from the forest research programs in Florida and the Southeastern and Southern Forest Experiment Stations is of special interest to forestland managers. In Florida, the research centers at Olustee, Marianna and Ft. Myers are conducting research on pine resin production, logging equipment, fertilization of planted pines and tropical forestry. At the University of Florida, the research of special interest to forestland managers includes projects on water control for forest production, genetics, timber management and wildlife.

Other Programs

The Rural Electrification Administration, through its rural electrification program has significant bearing upon the development and management of water and related land resources.

Soil and Water Conservation District Program

The Basin is served by 19 soil and water conservation districts organized on a county-wide basis with 7 being entirely in the Basin and 12 partially within its boundaries. They are legal subdivisions of the State and were created under the provisions of the Soil Conservation Act, Chapter 582 - Florida Statutes, passed by the 1937 Florida Legislature.

Each soil and water conservation district is directed by a board of supervisors made up of five local land owners within the district. This board of supervisors decides upon a district-wide program and plan of action. The program is prepared by the supervisors after consulting with local citizens and considering technical information made available by the U. S. Department of Agriculture, State agencies and other sources.

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Each district has a basic memorandum of understanding with the U. S. Department of Agriculture which allows any of the Department's agencies to assist the district in carrying out the objectives of its program.

The Soil Conservation Service has the major job of providing technical assistance to individual land owners and operators and groups in planning and carrying out soil and water conservation works of improvement. This assistance includes: Providing detailed soil and land capability maps, range site and range condition maps, specific information concerning the different safe uses and adapted crops, including grasses, trees, and plantings for wildlife food and cover for each kind of soil; consultation services from professional soil conservationists in helping develop basic soil and water conservation plans; technical services as needed to design, lay out and help supervise construction of water control measures for water impoundment, irrigation, drainage and other purposes; advice and assistance to help the landowners decide on the varieties of plants, seeding methods, soil building plants and trees; and supply answers to technical questions that may arise in managing pastures, rangelands, woodlands, wildlife, or in developing income-producing recreation enterprises. To date, over 6400 or almost 50 percent of the landowners in the study area have taken advantage of the assistance made available through their soil and water conservation districts and have developed basic soil and water conservation plans on their holdings.

Soil and water conservation districts are the principal means for local administration of watershed projects under the Watershed Protection and Flood Prevention Act (Public Law 566). Where the district lacks legal authority or financial means to administer a project alone, it arranges with other local governmental subdivisions such as county commissions, drainage districts or flood control districts who have such authority to co-sponsor the projects.

The U. S. Department of Agriculture provides technical assistance, cost sharing and credit principally for flood prevention and agricultural water management. Local sponsors may include municipal and industrial water supply by paying the additional costs, and may add recreation developments on a cost-sharing basis. Each project is initiated and administered by the local sponsoring organizations which must have authority under State law to carry out and maintain the needed works of improvement in order to be qualified for federal assistance. Ten applications, covering approximately 911,000 acres, have been submitted requesting assistance on watershed projects in the Basin.

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S E C T I O N V I

WATER AND RELATED LAND RESOURCE DEVELOPMENT POTENTIAL

Availability of Land for Potential Development

Agriculture

Land resources in the Basin, even though subject to limitations and hazards for some specific uses, are generally suited to the agricultural production necessary to meet projected needs. Temperature limits the production of citrus and early vegetable crops to the southern part of the Basin. This limitation in turn results in a higher percentage of the soils subject to excess water hazard being utilized for citrus production. The 1965 inventoried agricultural and non-agricultural use of the soil resources along with the projected future use (by 2020) are shown on Figures 6-1 thru 6-6. The soil resources are adequate to meet the Basin's share of projected needs for agricultural commodities and to provide for non-agricultural users, provided the needed works of improvement are installed. The areas in forestland, rangeland, and miscellaneous agricultural uses are expected to show substantial losses by the year 2020.

Forestry

The forestland acreage is expected to continue to decline as a result of land use changes. These reductions are expected to come from farm ownerships and miscellaneous private ownerships, as these groups include the smaller owners and many owners who do not depend on timber growing for their livelihood. Forest industry ownerships will lose their share of acreage to highway construction, urbanization, and other types of rights-of-way, but can be expected to acquire enough additional land to maintain their present acreages. State and National Forest ownerships are expected to increase slightly through the purchase of recreation sites with funds made available through the Land and Water Conservation Act.

Loss of forestland acreage will also be caused by works of improvement related to water management by federal and state agencies and private enterprises. In addition to land losses to reservoir sites, waterways and canals, some land use changes from forestland to citrus, other crops and pasture will result from works of improvement.

The estimated acreages of forestland that will be lost to water storage impoundments and canals are based on planned and potential projects and the works of improvement that will be necessary to meet the projected needs for agricultural products. The estimated acreages of pine, hardwood and cypress that will be taken out of production are based on 1965 conditions.

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By 1980, indications are that 50,900 acres of forestland will be taken for water impoundments and canals for navigation, flood control, flood prevention, and water management. The construction of the Cross-Florida Barge Canal will inundate 32,500 acres in hardwood and cypress.

Other navigation and flood control projects will require 7,700 acres, and 10,700 acres will probably be used for flood prevention and water management works of improvement. In these latter areas, 9,000 acres of pine and 9,400 acres of hardwood and cypress will be taken out of production.

After 1980, it is expected that 31,200 acres will probably be required for water development projects. The construction of navigation and flood control projects will remove 15,700 acres from production, and flood prevention and water management will require an additional 15,500 acres. Of the total forestland taken out of production, it is estimated that 19,700 acres will be growing pine and 11,500 acres will be from hardwood and cypress.

In summary, by 2020, 82,100 acres of forestland will be taken out of production by the construction of water development projects. Of this area, an estimated 28,700 acres will be taken from pine land and the remainder (53,400 acres) from hardwood and cypress.

Other

Farsighted resource management is especially important since future development depends greatly upon positive inducements offered to people with capital to become a part of a high income economy. Decisions of agriculturalists, manufacturers, vacationers, retirees and others will be strongly influenced by the environment established in the Basin and the amenities and facilities available to them.

Recreation facilities are high on the list of desirable items in the development of the land and water resources. Faced with limited resources, and a seemingly unlimited human requirement for outdoor recreational pursuits, efforts should be exerted toward the development of present recreation areas to their full potential and to the acquisition of additional sites. With this in mind, certain areas were designated as "reserve areas" in the land use projections. (Figure 6-7). The reserve areas are either adjacent to water areas or near potential water impoundment sites. No attempt has been made to plan or project the type of development that might be accomplished for these areas.

USE OF SOIL RESOURCE BY SOIL CAPABILITY CLASSIFICATION

St. Johns River Basin and Intervening Coastal Areas

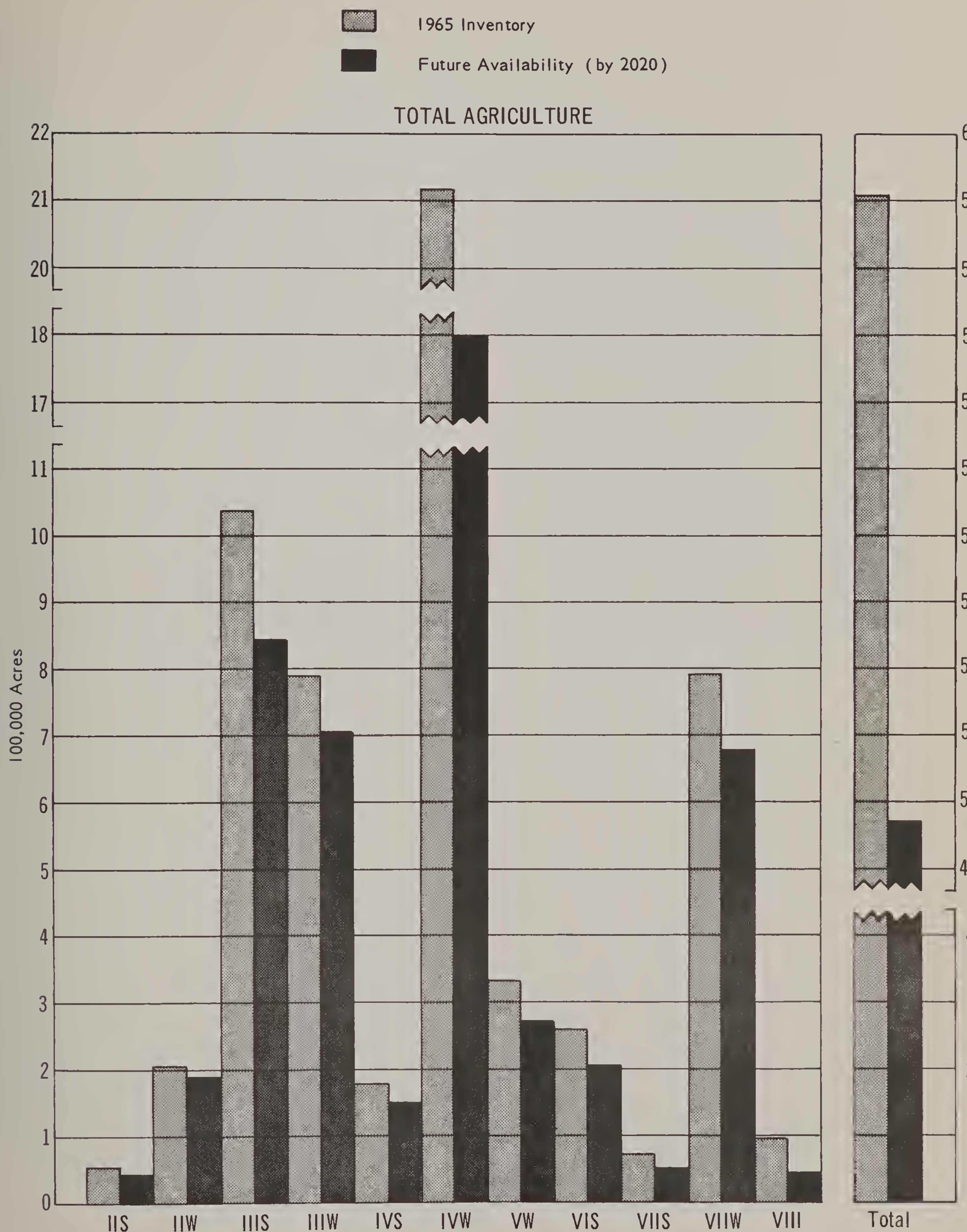

Figure 6-1

4-27090 9-68

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, GAINESVILLE, FLORIDA

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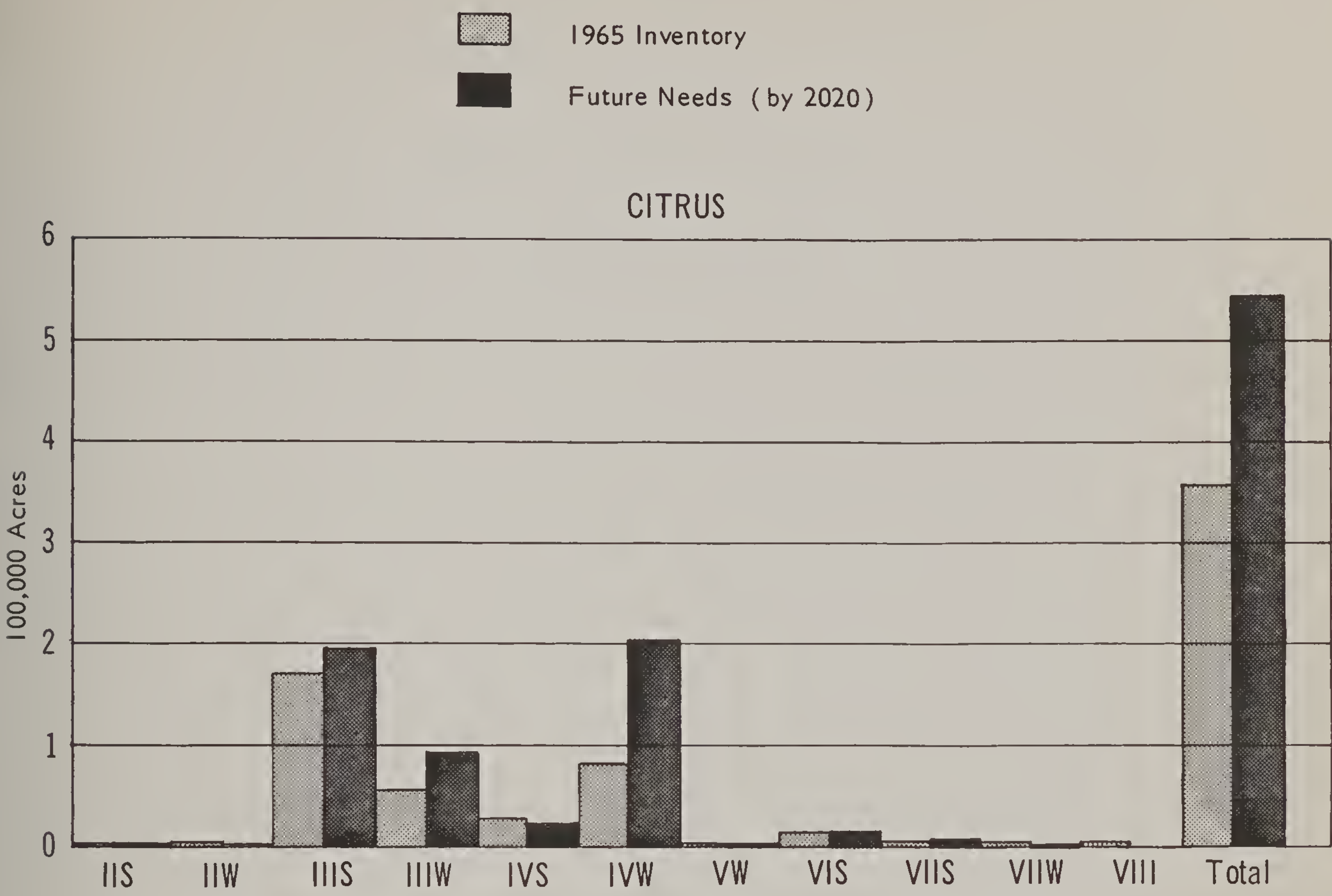
USE OF SOIL RESOURCE BY SOIL CAPABILITY CLASSIFICATION
St. Johns River Basin and Intervening Coastal Areas



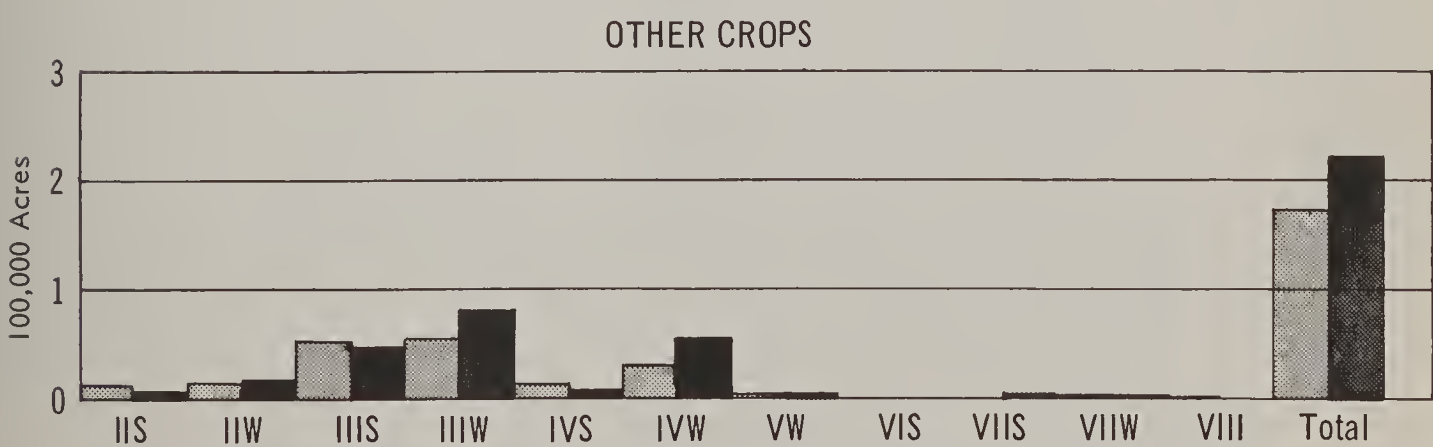


Figure 6–2

4–27090 9–68
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USE OF SOIL RESOURCE
BY
SOIL CAPABILITY CLASSIFICATION

St. Johns River Basin and Intervening Coastal Areas

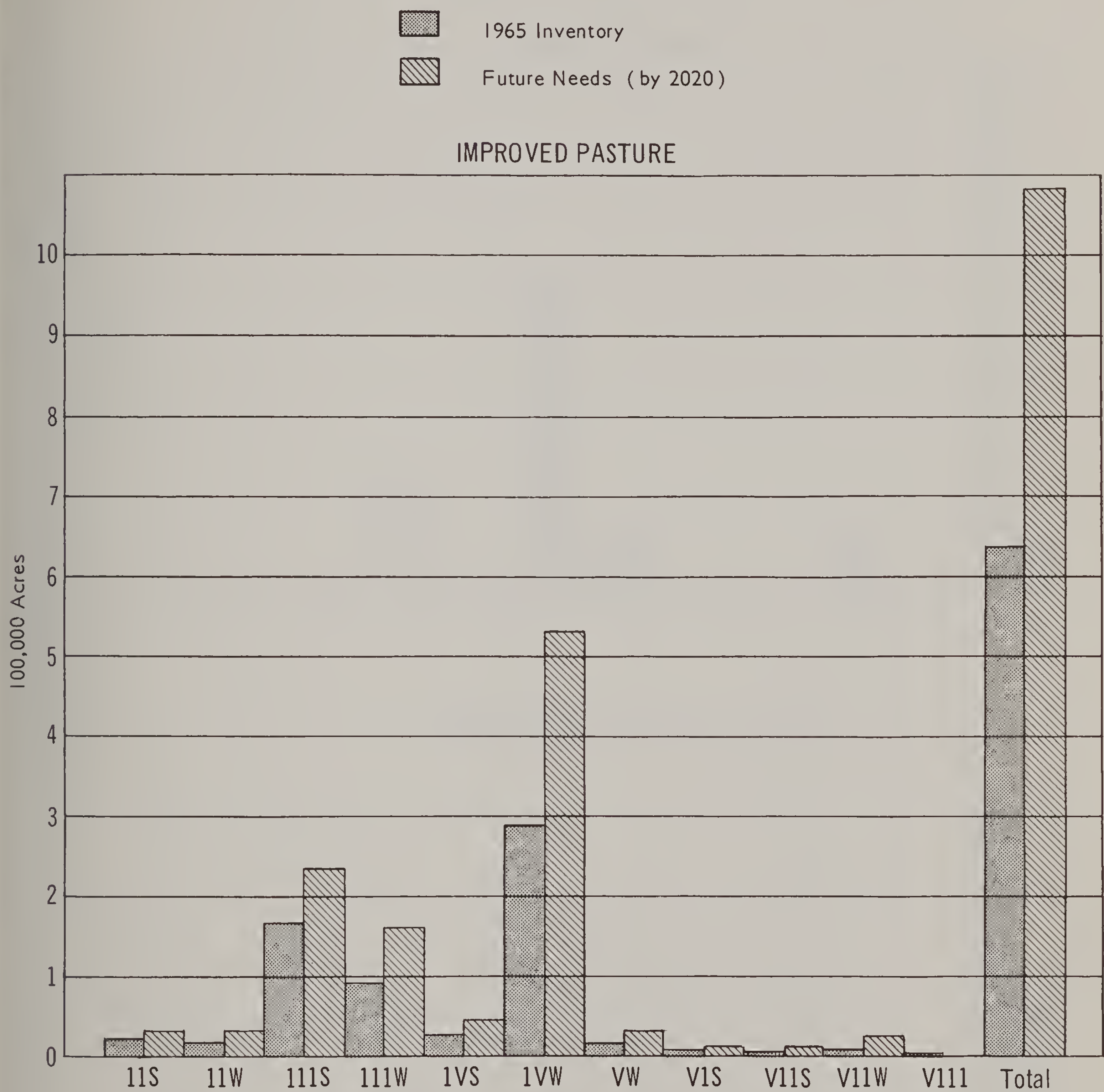

Figure 6–3

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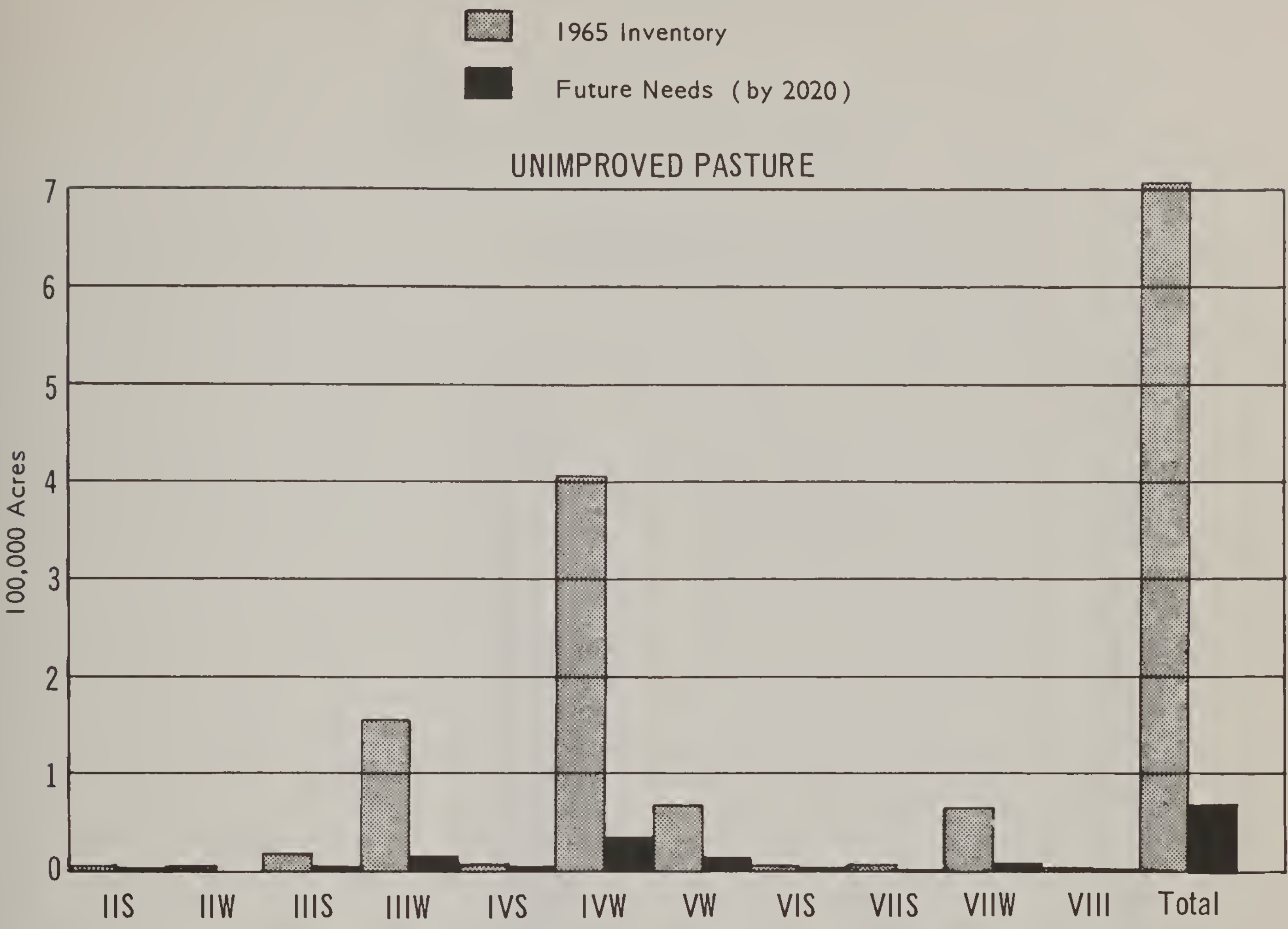
USE OF SOIL RESOURCE BY SOIL CAPABILITY CLASSIFICATION
St. Johns River Basin and Intervening Coastal Areas



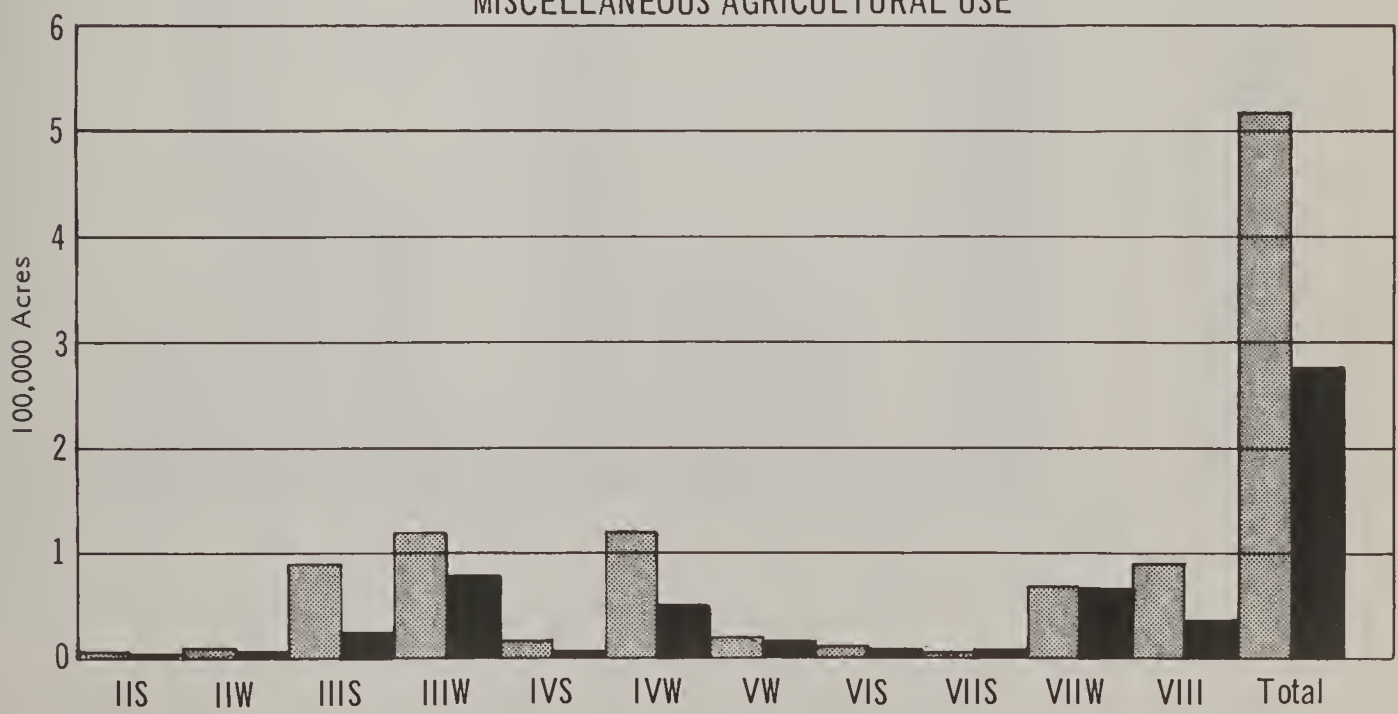


Figure 6–4

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USE OF SOIL RESOURCE BY SOIL CAPABILITY CLASSIFICATION

St. Johns River Basin and Intervening Coastal Areas

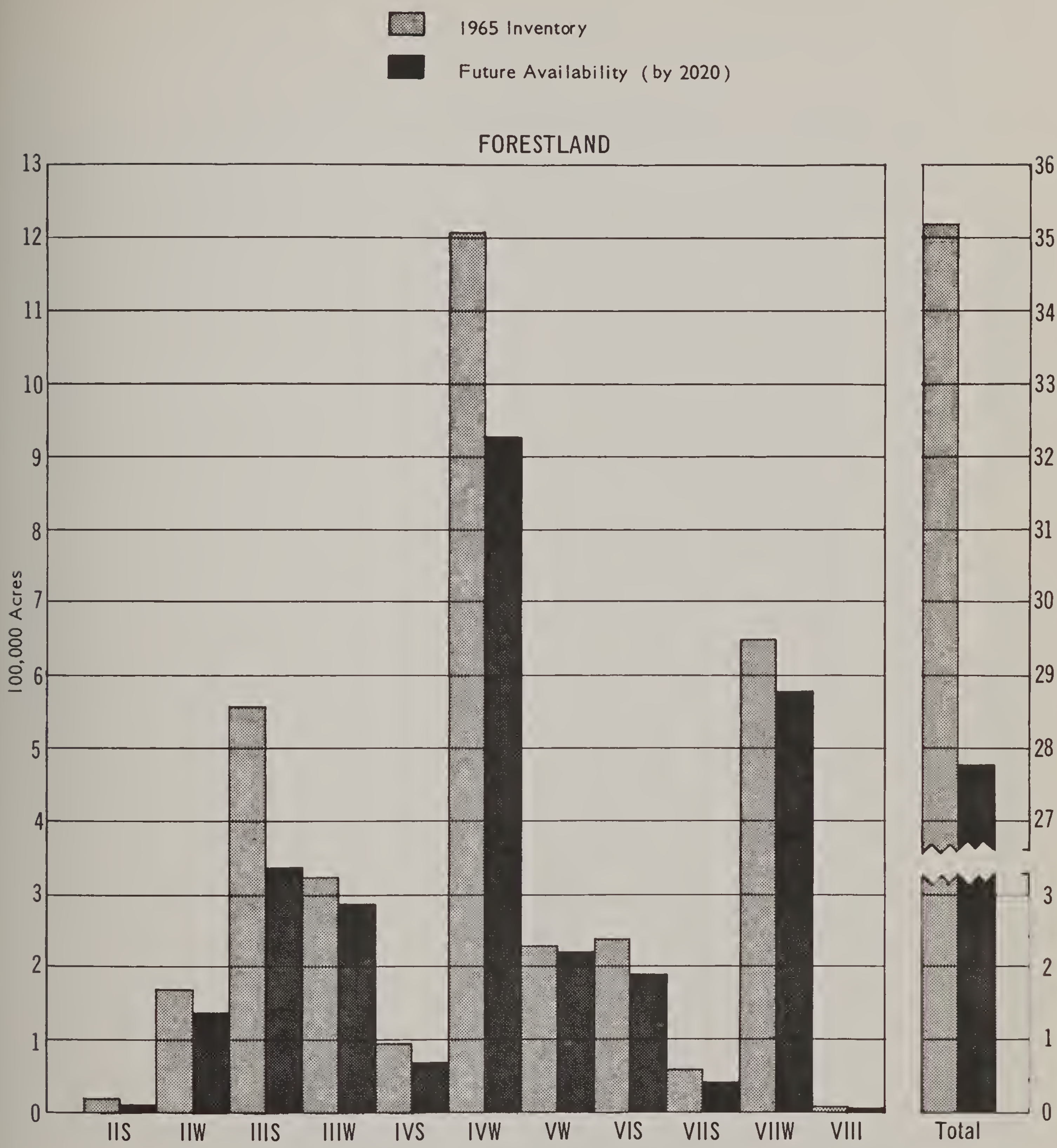

Figure 6–5

4–27090 9–68
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USE OF SOIL RESOURCE BY SOIL CAPABILITY CLASSIFICATION

St. Johns River Basin and Intervening Coastal Areas

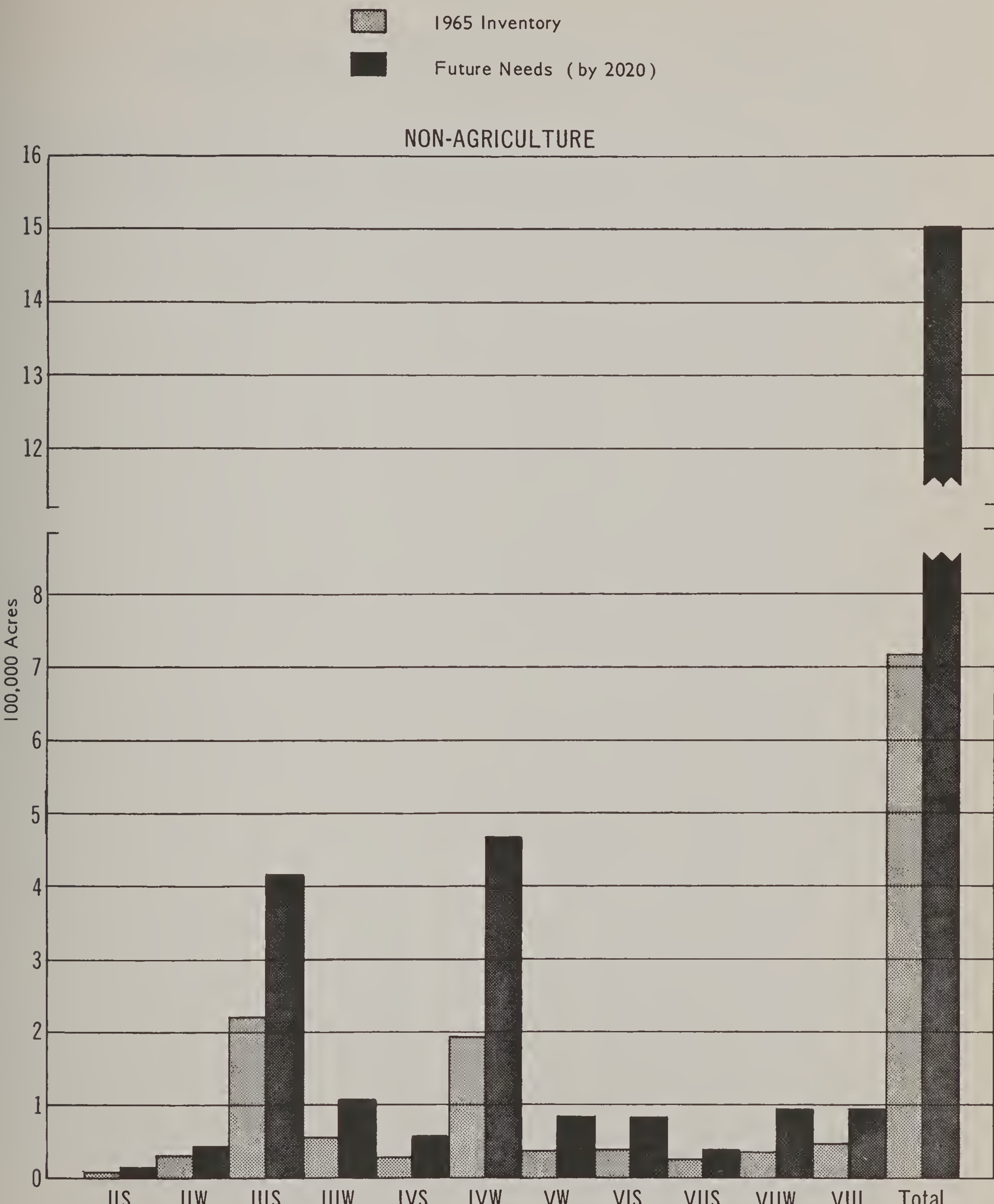

Figure 6–6

4–27090 9–68

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The acreages in the potential reserve areas are shown in the following table, and indexed for Figure 6-7.

TABLE 6.1 - Potential Reserve Areas

Map Index	Land	Water	Total	Map Index	Land	Water	Total
	(1000 ac.)				(1000 ac.)		
A	10.8	1.0	11.8	H	30.6	0.0	30.6
B	8.6	1.0	9.6	I	6.1	1.7	7.8
C	14.4	1.9	16.3	J	3.2	0.8	4.0
D	8.2	2.2	10.4	K	29.0	5.1	34.1
E	2.1	1.7	3.8	L	7.1	1.2	8.3
F	4.0	0.7	4.7	M	0.9	0.5	1.4
G	2.6	0.0	2.6	Total	127.6	17.8	145.4

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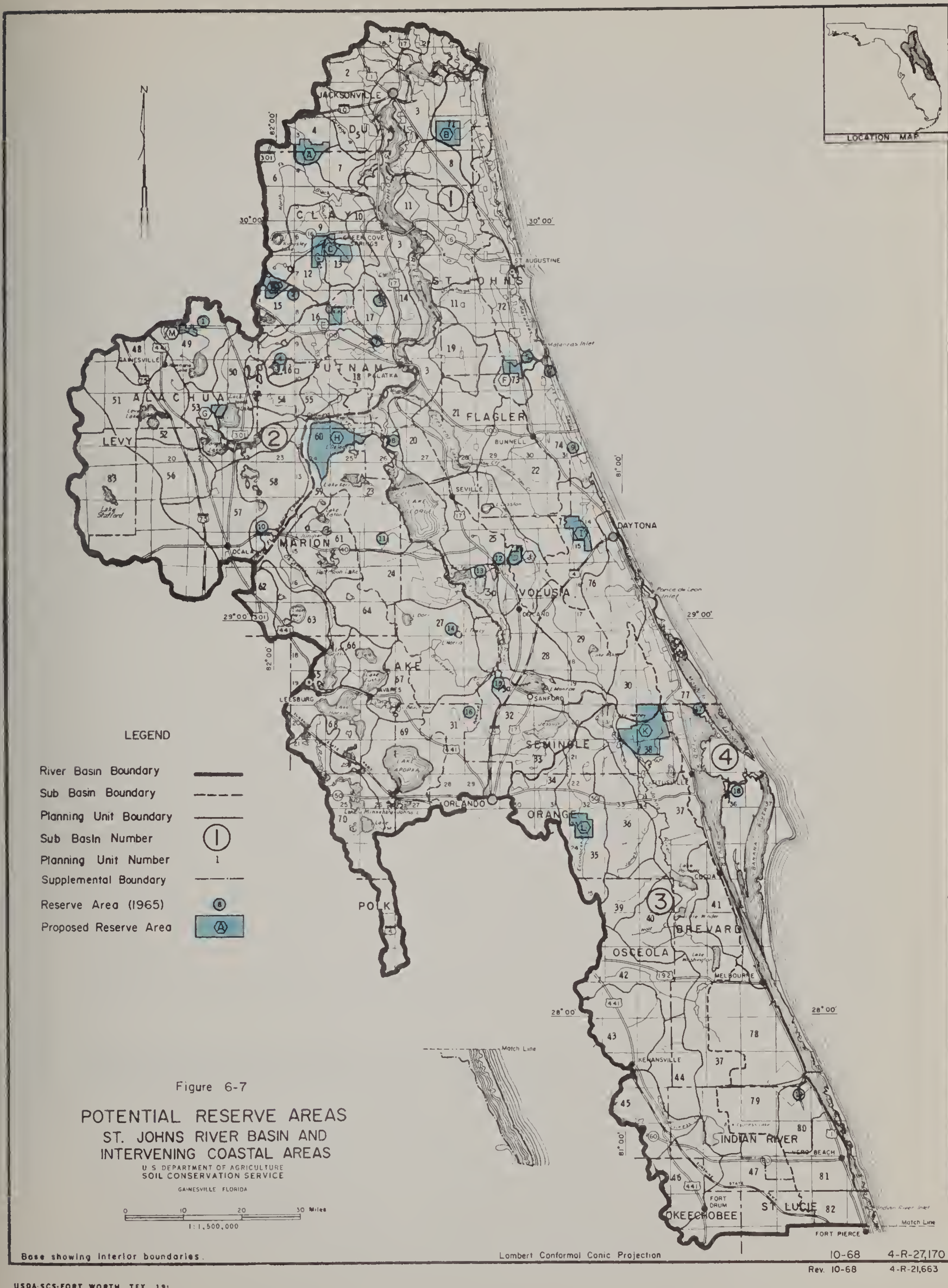

Figure 6-7

POTENTIAL RESERVE AREAS
ST. JOHNS RIVER BASIN AND
INTERVENING COASTAL AREAS
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

USDA-SCS-FORT WORTH, TEX. 19'

SECTION VII

OPPORTUNITIES FOR DEVELOPMENT AND IMPACTS OF USDA PROGRAMS

Development Opportunities

Land Treatment Programs

Opportunities offered through the conservation programs will contribute materially to reducing hazards in the development and use of the soil resources. Of the 5,905,600 acres of soils used primarily for agriculture in 1965, 1,679,700 acres (28 percent) are well drained to moderately well drained, but have problems of inherent low fertility, erosion, or root-zone limitations due to shallow soils or low moisture-holding capacity. Projected shifts in the utilization of the land resources toward more intensive uses will necessarily result in more of these soils being used for non-agricultural purposes. Over the next 10 to 15 years, 28 percent or 1,554,400 acres of the remaining 5,547,900 acres of projected agricultural land will need conservation treatment, including continuation of present conservation practices. Projections indicate that by 2020, 1,332,000 acres or 27 percent of the 4,970,000 acre agricultural base will be on these lands.

Agricultural lands on which the dominant problem is excess water comprised 4,225,900 acres or 72 percent of the total agricultural land in 1965. Treatment measures had been applied on 250,000 acres. Projected shifts in the utilization of the land resources, with more of the non-wet lands going to non-agricultural uses, will necessarily result in increases in the agricultural use of soils with excess water hazards. Indications are that for immediate needs, 3,993,500 acres (72 percent) and for future needs, 3,638,000 acres (73 percent) of the soils used for agriculture will have these hazards. Land treatment measures to reduce hazards of excess water can be partially attained through current programs offering assistance to individual farmers. For effective individual action to be accomplished, and in order for the soil resources to be used to their potential, the water management program for flood prevention and drainage through project action should be intensified.

Cooperative State-Federal Forestry Programs

Greater use can be made of the 248,000 acres of unprotected forestland if cooperative forest fire protection is extended to these areas. In addition to timber production, these areas would have greater possibilities as recharge areas, recreation sites, or wildlife and hunting areas. The same level of cooperative forest fire protection that exists throughout protected areas in the Basin is adequate for all anticipated uses of this forestland.

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State and federal forestry agencies have an opportunity to contribute toward increasing the use and productivity of forestland through their cooperative programs. Between now and 1980, the 1,528,000 acres of forestland in public and industrial ownerships can be expected to furnish the greater part of the added growth needed to maintain the present level of production. Public and industrial forestland owners can be expected to take the initiative in making greater use and increasing the productivity of their land by developing better forest management practices, better tree species, by participating in forest research and by making use of technical and financial assistance available through the cooperative forestry programs.

By 1980, it is estimated that 1,732,000 acres of forestland will be controlled by farm and other private ownerships. The opportunities for increasing use and productivity of forestland are in working with the owners in the above groups. A major goal should be to achieve better forest management on lands under their control during the next 15 years. The combined efforts of all the agencies working with cooperative state-federal forestry programs are needed to motivate forestland owners to make better use of their land, and to give them technical assistance. An intensive program to accomplish this, emphasizing assistance to small forestland owners, should include: (1) Obtaining greater participation by small forestland owners in the cooperative forestry programs, (2) motivating these forestland owners to work toward improving the timber stands on the land that will remain in timber to better serve as recharge areas, recreation sites, wildlife and hunting areas, or timber production areas, (3) furnishing up to date information on marketing and utilization of wood products including economical methods of harvesting, (4) assisting landowners in obtaining the use of mechanical timber harvesters on a rental basis, (5) initiating some means of assistance to small forestland owners enabling them to avoid "desperation sales" in cases of emergency, (6) stimulating the interest of landowners in making greater use of existing forestland, planting trees on idle land suitable for this purpose, and regenerating stands of timber on areas from which a timber crop has been harvested.

The goals of the above program are to meet the needs of a growing population for water, recreation and wildlife on a decreasing acreage of forestland and still maintain timber production.

Before 1980, 531,000 acres should be planted and 125,000 acres treated with timber stand improvement measures, at an annual cost of $677,000 or a total cost of $10.2 million. The best sites should be treated in order to increase growth rates as rapidly as possible.

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Between 1980 and 2000, 1,430,000 acres should be planted and 627,000 acres should be treated by timber stand improvement measures, at an annual cost of $1.1 million and a total cost of $22.5 million. It is anticipated that water control will be installed on about 200,000 acres, originally of poor site quality, changing them to fair or good site quality at an estimated total cost of $1.7 million. To supply the needed forest growth for this time frame, the production per acre of forestland must be increased by one and one-half times the amount in 1965.

By 2020, the forestland acreage will probably be reduced to 2,772,600 acres, most of which will be in planted stands, or stands that have been treated with timber stand improvement measures. It is estimated that 10 percent of the acreage will be on poor sites or in wildlife areas from which a limited amount of timber will be harvested. The cost of site preparation and replanting the harvested areas to maintain production is estimated to be $1.3 million annually with a total cost approaching $26.5 million.

The forest management program on Table 7.1 includes extending forest fire protection to unprotected areas and increasing technical assistance to landowners to meet immediate needs. An accelerated rate of planting and timber stand improvement is shown between 1965 and 1980 and for the future. The present level of providing wood products can be maintained on fewer acres of forestland if the above program is initiated at an early date. In addition, the forest cover will reduce overland flow of storm runoff and contribute to recreation, wildlife and environmental values. Increased technical assistance to private forestland owners under cooperative forest management authorities can be expected to improve cutting practices. Proper skid trail and logging road location, construction and maintenance will tend to minimize the disturbance of soil by timber harvesting.

Figure 7-1 shows the present cut, growth and inventory of growing stock and compares the projected amounts under the present level of forest management with those that can be expected under intensive forest management. Under the present level of forest management, annual cut will exceed annual growth within the next 20 years and thereafter decrease the growing stock. With intensive forest management, the needed annual cut can be supplied without changing the present cut-growth balance.

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TABLE 7.1 - Forest Management Program, St. Johns River Basin - 1965-2020[1/]

Forestland Treatment Measure	With Current Programs		Additional With Accelerated Program		Needs Met With Accelerated Program	Annual Cost of Accelerated Program
	(1000 ac)	(Percent)	(1000 ac) 1965-1980	(1000 ac) 1980-2020	(Percent)	(Dollars)
Fire protection	3266.3	93	248.2	-	100	73,000
Improved Harvesting, including proper skid trail and logging road location & construction	1792.9	55	1467.3	-	100	60,000
Planting, including site preparation, regeneration of understocked stands, and watershed protection	428.6	81	102.4	288.3	100	96,000
Timber stand improvement	1.9	1.5	123.1	617.6	100	108,000

1/ Increases figured on an annual basis

CUT, GROWTH AND INVENTORY OF GROWING STOCK
St. Johns River Basin and Intervening Coastal Areas

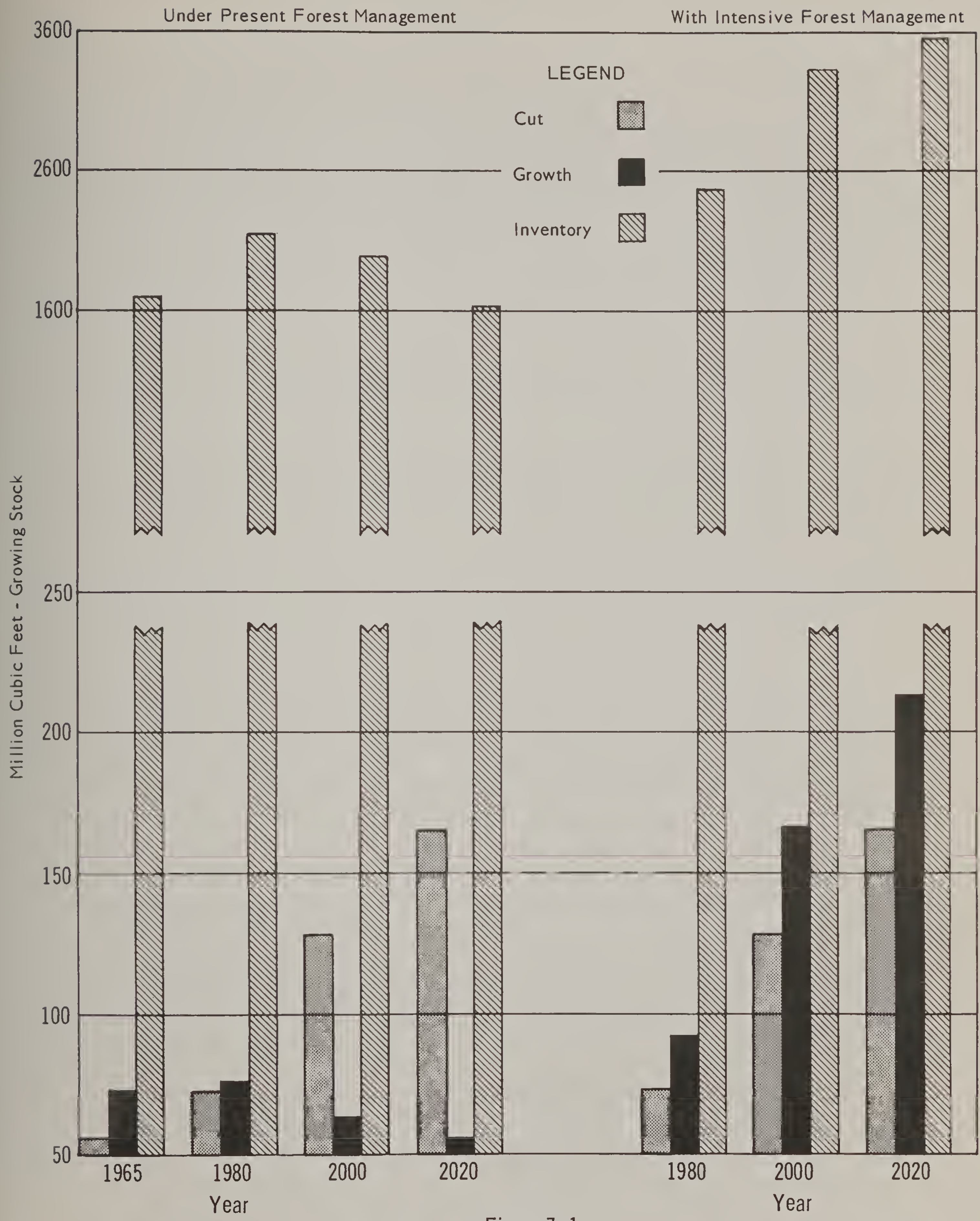

Figure 7–1

4–27090 9–68
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Ocala National Forest Development Program

Plans for the future development of the Ocala National Forest include expansion of the transportation system and the construction of additional recreation sites. Recreation use will increase many fold by 2020. Much of this increase will occur on Rodman and Eureka Reservoirs when this section of the Cross-Florida Barge Canal is completed across National Forest land by the Corps of Engineers. The Forest Service will provide extensive recreation facilities on National Forest land at these reservoirs.

The annual acreage planted and seeded for timber production will be more than doubled by 1980 then decrease slightly in future years.

The acquisition of land by purchase and exchange will continue until 2000 in an effort to acquire lands needed for public outdoor recreation purposes and the consolidation of National Forest lands.

The range program includes an extensive range analysis and site preparation, reseeding and fertilizing to increase the quantity and improve the quality of the forage. Range improvements to control livestock and provide a water supply are recommended.

The objectives of wildlife management are to produce the maximum numbers of wildlife consistent with other resource values. It is expected that the deer herd will reach the critical point by 1980, after which time population controls will be needed. By the year 2000, the number of hunters will be limited. Future development plans recommend converting about five percent of the forest area into well dispersed wildlife openings. Wildlife forage plants will be released. Key wildlife areas which are mostly hardwood bottom areas and seeded wildlife plots will be fenced and seeded or planted to desirable wildlife foods. Water supply will be insured by blasting shallow water impoundments.

Waterfowl habitat development consists of planting duck food and providing nesting boxes for wood ducks. An impoundment constructed in connection with the Cross-Florida Barge Canal is included in the plans.

A big game range analysis and wildlife habitat surveys of small game and non-game species are planned.

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Improvements and surveys will be made on streams and lakes. Streams support only warm water species of fish. The primary improvement planned is debris removal including water hyacinth control. The improvement planned for lakes calls for liming, fertilization, rough fish removal, and stocking with desirable species.

The amounts and estimated costs of the planned future developments are shown in Section B of the Appendix, Tables 14, 15 and 16.

Potentials - Planning Units

The use of the land and water resources of the Basin for immediate needs (next 10 to 15 years) and future needs (by the year 2020), for the continued and increased production of agricultural products will require the installation and management of major works of improvement. These improvements will be needed to combat hazards and limitations associated with the agricultural use of the resources. Water management - providing and managing adequate structural facilities to reduce the damaging effects of floodwater and replacing or maintaining soil moisture at desirable levels for optimum plant growth during periods of deficient rainfall- along with the conservation of the soil and water resources, are important items of consideration.

The development of the soil and water resources on a planning unit (small watershed) basis offers communities an excellent opportunity to solve soil and water problems in a coordinated manner, compatible with a basin-wide program of development, conservation, and management.

The Basin was subdivided into 86 planning units. The subdivisions are identified by name and number in Table 7.2 and by location on Figure 7-2. These units are identified according to the Conservation Needs Inventory system as follows - Map Index Numbers 1 through 47, Fla. S.A.G. St. Johns R.B. & I.C.A. (St. Johns R. 15-1 through 47); Number 48 through 70, Fla. S.A.G., St. Johns R.B. & I.C.A. (Fla. 0-71 through 82); and Number 83, Fla. S.A.G. Fla. W.C.T. - 35a (Waccasassa R. 21-35a), and Fla. S.A.G. Fla. W.C.T. - 35b (Waccasassa R. 21-35b).

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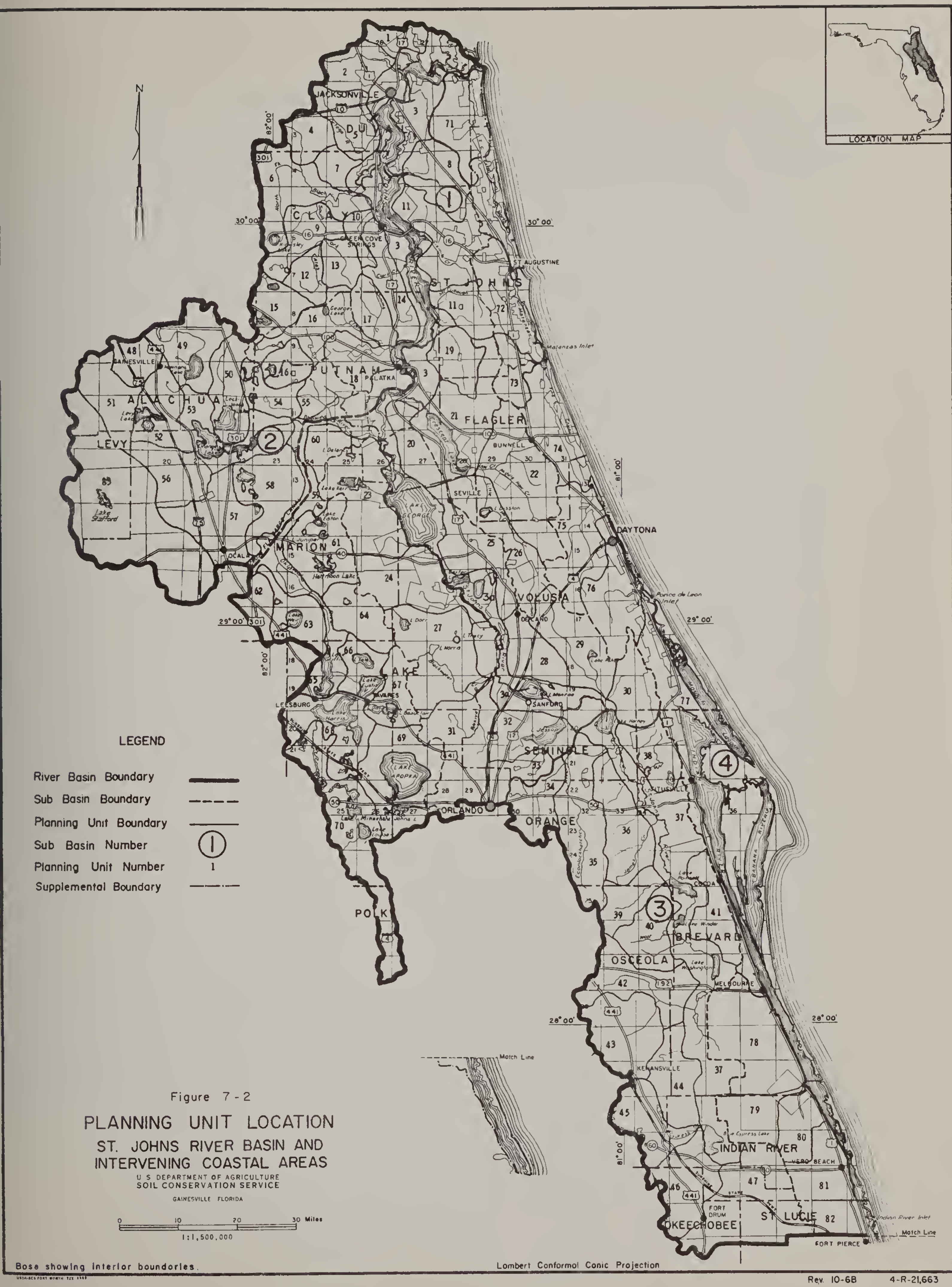

Figure 7-2

PLANNING UNIT LOCATION

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

TABLE 7.2 - Index of Planning Units

Planning Unit Name	Map Index Number	Planning Unit Name	Map Index Number
Cedar Creek and Sweetwater Creek	1	Simms Creek	17
Trout River	2	Rice Creek	18
Lower St. Johns River Main Stem	3	Deep Creek	19
Middle St. Johns River Main Stem	3a	Lake Margaret	20
Yellow Water Creek	4	Crescent Lake	21
Ortega River	5	Haw Creek	22
North Fork Black Creek and Black Creek	6	Lake Kerr, Salt Springs Run and Juniper Creek	23
Little Black Creek	7	Alexander Spring Creek	24
Julington Creek	8	Pierson	25
South Fork Black Creek	9	Lake Disston and Little Haw Creek	26
Peters Creek	10	Black Water Creek	27
Six Mile Creek and Trout Creek	11	Orange City	28
McCullough Creek and Moccasin Creek	11a	Lake Ashby	29
Ates Creek	12	Cow Creek	30
Greens Creek	13	Wekiva River	31
Governor's Creek, Clark's Creek and Cedar Creek	14	Lake Jessup	32
Keystone Heights	15	Howell Creek and Orlando	33
Etonia Creek	16	Little Econlockhatchee River	34
Levy's Prairie and Lake Area	16a	Econlockhatchee River	35
		Christmas	36
		Upper St. Johns River Main Stem	37

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TABLE 7.2 - (Cont)

Planning Unit Name	Map Index Number	Planning Unit Name	Map Index Number
Salt Lake	38	N.E. Ocala National Forest	60
Taylor Creek	39	Lynn	61
Cox Creek, Wolf Creek and Pennywash Creek	40	Belleview	62
Rockledge and Cocoa	41	Lake Weir	63
Jane Green Creek	42	Ella Lake	64
Bull Creek	43	Lake Griffin	65
Ten Mile Creek, Wolf Creek and Six Mile Creek	44	Lake Eustis and Lake Yale	66
Blue Cypress Creek	45	Lake Dora	67
Ft. Drum Creek	46	Lake Harris	68
St. Johns Drainage District	47	Lake Apopka	69
Hogtown Creek	48	Palatlakaha River	70
Newnan's Lake and Hatchett Creek	49	Pablo Creek and North River	71
Lochloosa Lake and Lochloosa Creek	50	San Sebastian River and Moultrie Creek	72
Long Pond	51	Pellicer Creek	73
Paynes Prairie	52	Matanzas River and Bulow Creek	74
Orange Lake	53	Tomoka River	75
Little Orange Lake	54	Spruce Creek	76
Cabbage Creek and Sweetwater Creek	55	Indian River	77
Reddick	56	Palm Bay	78
Ocala	57	Fellsmere	79
Ft. McCoy	58	Sebastian River Drainage District	80
Oklawaha River	59	Indian River Farms Drainage District	81
		Ft. Pierce Farms Drainage District	82
		Lake Stafford	83

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All of the planning units meet the size limitation of 250,000 acres imposed by Public Law 566 criteria, except the main stem of the St. Johns River (Numbers 3, 3a, and 37) and units 77 and 83. Units 15, 16a, 51, 56, 57, 62 and 83 do not have surface outlets and are important as recharge areas.

It is not considered feasible to provide facilities that will eliminate all flooding, but, rather the channels are designed to remove the floodwater within a period of time compatible with the tolerance of the crop being grown.

The extent of land subject to excess water hazards less the acreage adequately treated in 1965 resulted in the estimated acreage needing treatment. These acres, by land use projected to meet immediate and future needs, became the basis for estimating flood prevention and agricultural water management needs in the evaluation of the planning units. Sixty-four units were evaluated to determine, as nearly as possible, the technical and economic feasibility of providing works of improvement for the purposes of flood prevention, drainage, and irrigation on agricultural lands. Included in this group of 64 are two units (80 and 82) which already have completed PL-566 work plans, but modifications would be needed to fit them into the water management proposals for the Upper St. Johns Area.

Twenty two units were not included in the benefit-cost evaluations. One of these, number 70, has an approved Public Law 566 Work Plan. The remaining 21 units include units 3, 3a and 37, the mainstem of the St. Johns River; 59, the Cross-Florida Barge Canal; 15, 16a, 51, 56, 57, 62 and 83, areas of little or no surface runoff; 23, 24, 60, 61, and 64, comprising the Ocala National Forest; 5, 28, 33, 48 and 77 having in excess of 60 percent of the area in non-agricultural uses. (Figure 7-2). The relatively insignificant source of potential agricultural problems and sources of benefits in the latter group makes development under present PL 566 criteria unlikely. Where urban flooding is of significance, the Soil Conservation Service and the Corps of Engineers will coordinate their efforts in accordance with the "Agreement Between the Corps of Engineers, Department of the Army, and Soil Conservation Service, Department of Agriculture, on Participation in Urban Flood Protection."

As a means of determining the degree of local interest in project action in the planning units, a number of local groups, organizations and prominent landowners were contacted. Included in these groups and organizations were the concerned soil and water conservation district supervisors, the county commissioners, officials of the Central and Southern Florida Flood Control District, and professional agricultural workers within the respective counties in the Basin. There was interest shown, along with assurance of cooperation in working with watershed sponsors in the development of plans and in the construction, operation, and maintenance of needed and feasible works of improvement.

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Potential works of improvement included in the Watershed Investigation Reports (Planning Unit Appendix) are to supplement existing or proposed works of improvement by other federal and state agencies and are not replacements for such works.

The planning units in the Upper St. Johns and Intervening Coastal Area were evaluated as a single unit. Of the units in this area, Number 82 and a portion of 80 have completed PL-566 work plans. However, modifications in the works of improvement are needed to accomplish the desired water management objectives for the project area. The other units in the Upper St. Johns - 45, 46, 47, 79 and the remainder of Unit Number 80 need improved flood prevention, drainage and irrigation facilities. The Upper St. Johns Area is affected by critical water availability problems from both a quantity and quality standpoint. Works of improvement needed to provide irrigation water - including the reservoir and associated channels for collecting storm runoff for storage and later distribution back to the land for irrigation - would serve the entire area; therefore, one cost and benefit analysis is presented for this group of units.

Planning Unit Number 78, Palm Bay Watershed, is also in an area of critical water needs, in terms of quality and quantity. A watershed investigation report has been prepared for this planning unit, as well as for the Upper St. Johns Area, and Planning Units 58 and 76.

It was found that 30 of the 64 units evaluated are feasible, including units 80 and 82 mentioned above. Seven of these evaluated were considered marginal and 27 not feasible for immediate needs, (Figure 7-3). Six additional units were found to be feasible under future needs conditions. The proposed works of improvement generally consist of systems of channels with associated grade stabilization and water management structures to provide drainage, flood protection, and water conservation. Where suitable sites for reservoir development exist in the feasible planning units, these costs are included to serve the purposes of irrigation and recreation.

Agricultural benefits were based on acreages of citrus, other cropland, improved pasture, and forestland required to meet immediate and future needs, located on soils where flood prevention or water management measures will be needed. Sources of benefits considered in evaluating water management facilities on forestland were increased growth, better access, and better conditions for regeneration.

Results of the evaluations of feasible planning units found to be needed by 1980 and 2020, are shown in Tables 7.3 and 7.4 respectively.

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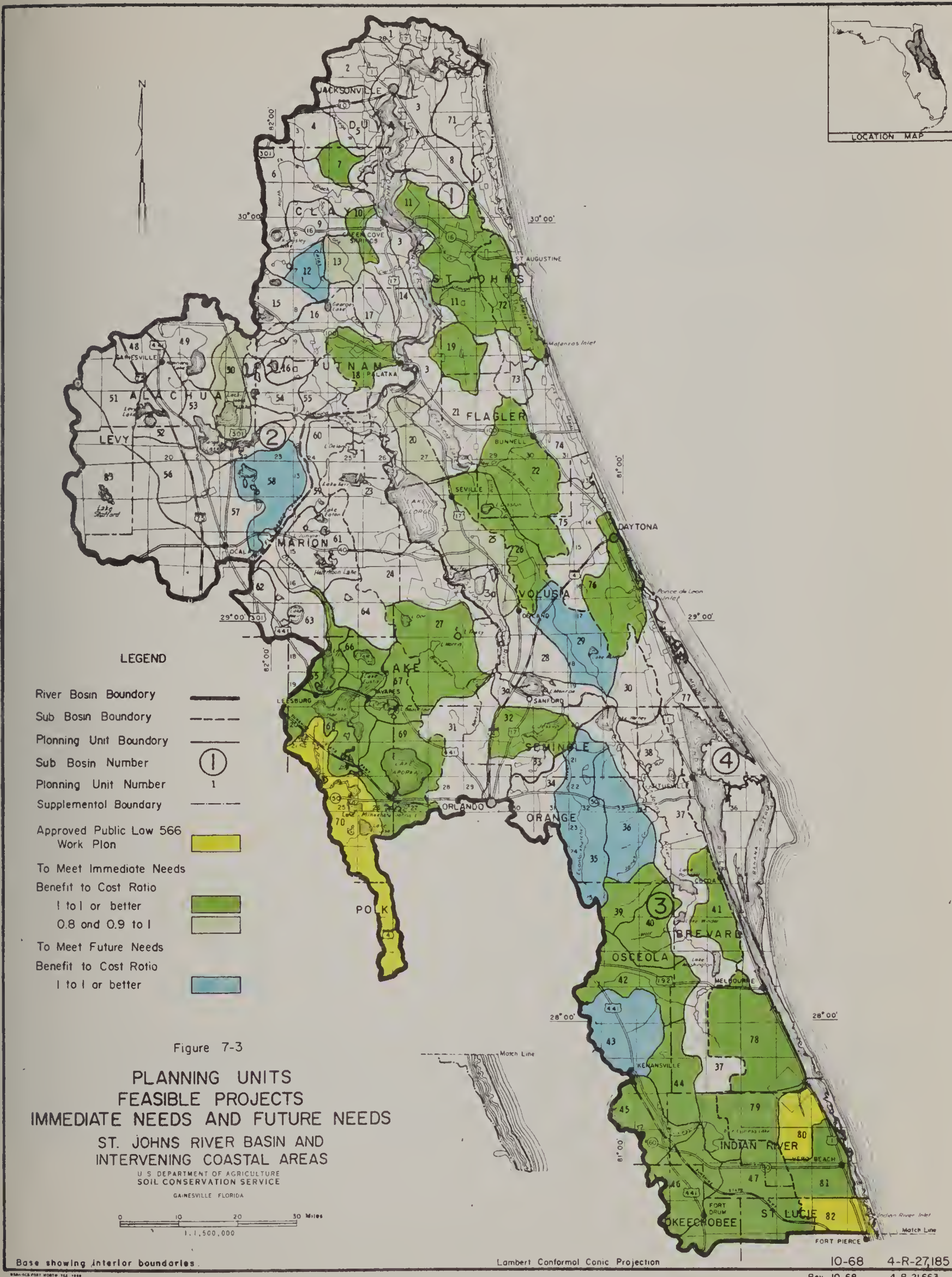

Figure 7-3

PLANNING UNITS
FEASIBLE PROJECTS
IMMEDIATE NEEDS AND FUTURE NEEDS
ST. JOHNS RIVER BASIN AND
INTERVENING COASTAL AREAS

TABLE 7.3 - Summary of Benefits and Costs for Feasible Planning Units To Meet Immediate Needs

Planning Unit Number	Total Installation Costs (Dollars)	Total Annual Costs (Dollars)	Total Annual Benefits (Dollars)	Ratio Benefits to Costs
7	258,800	15,900	19,100	1.2:1
10	146,800	9,000	9,800	1.1:1
11	1,006,700	49,600	79,900	1.6:1
11a	306,200	15,100	70,000	4.6:1
18	1,074,400	73,700	130,200	1.8:1
19	937,200	46,200	249,200	5.4:1
22 1/	951,700	51,800	122,000	2.4:1
26 1/	97,200	5,200	6,800	1.3:1
27	933,600	49,100	53,300	1.1:1
32	452,700	23,800	32,900	1.4:1
39	567,200	28,500	33,800	1.2:1
40	849,400	42,700	96,600	2.3:1
41	813,600	46,800	57,900	1.2:1
42	1,113,300	55,900	94,100	1.7:1
44	924,600	46,400	97,600	2.1:1
65	276,400	14,500	29,300	2.0:1
66	292,200	15,400	21,100	1.4:1
67	353,300	18,600	21,100	1.1:1
68	583,000	30,600	113,000	3.7:1
69	932,200	49,000	51,000	1.0:1
72	854,100	42,100	61,700	1.5:1
76	1,680,000	88,800	188,600	2.1:1
78	8,848,000	545,000	934,000	1.7:1
45,46,47,49	Upper St. Johns Group 2/			
80,81 & 82	41,700,000	2,748,000	4,980,000	1.8:1

1/ Units 22 and 26 comprise approximately the same area as that included in the preliminary PL-566 Plan for Haw Creek. Benefits and costs for these units were derived from this plan.

2/ This is the area included in Upper St. Johns Investigation Report. All of the planning units are in the vicinity of the proposed reservoir. Water needs are critical in this area. PL-566 plans are complete for all of Unit 82 and for a portion of 80. Costs shown on this table include costs for the reservoir and irrigation facilities, and for needed flood prevention and drainage measures.

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TABLE 7.4 - Summary of Benefits and Costs for Feasible Planning Units To Meet Future Needs

Planning Unit Number	Total Installation Costs (Dollars)	Total Annual Costs (Dollars)	Total Annual Benefits (Dollars)	Ratio Benefits to Costs
12	334,600	20,400	19,900	1.0:1
29	267,200	47,700	50,800	1.1:1
35	1,942,200	97,500	328,500	3.4:1
36	1,424,600	71,500	382,600	5.4:1
43	1,537,000	77,200	110,800	1.4:1
58	2,346,100	123,900	201,700	1.6:1

Costs for units 18, 58, 76, 78 and the Upper St. Johns (Units 45, 46, 47, 79, 80, 81 and 82) were developed individually, based on field surveys and calculations of actual quantities of excavation and materials. The estimated costs presented for all other planning units were determined by using composite costs per square mile obtained from sample units (PL-566 Work Plans and Units 18, 58 and 76.

Potential Fresh Surface Water Development

Agriculture

The topography of the Basin, being relatively flat, or without surface streams, limits the possibilities for providing appreciable amounts of additional fresh water storage for agricultural uses. However, there are some natural lakes that could be enlarged by the installation of controlled outlets. A few impoundment sites on streams could also be developed. Impoundments by closed levees (with pumps for back-pumping) can be developed for certain areas, some of which are covered in more detail in the Planning Unit Appendix. Where agricultural or multiple purpose water storage sites exist in feasible planning units, costs for these purposes are reflected in the installation costs for the planning units. However, the number of storage sites in feasible project areas is extremely limited. Most of these sites are too far removed from farming areas to be of value as sources of irrigation water.

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Other

There are several potential impoundment sites on fresh water streams and natural lakes in the northern portion of the Basin in planning units found to be not feasible under PL-566 criteria. These impoundments would be single purpose recreation structures and were therefore not evaluated monetarily. Development of these sites could fill a significant portion of the need for water oriented recreation in this area. A number of these sites are in individually owned forest areas, large timber ownerships, or military installations.

The locations of potential impoundment sites for additional surface water storage are indicated on Figure 7-4. Physical data for the sites are given in Tables 7.5 and 7.6.

TABLE 7.5 - Lakes With Additional Storage Potential

Site No.	Drainage Area (Acres)	Elevation Present (MSL)	Elevation With Structure (MSL)	Surface Area Present (Acres)	Surface Area With Structure (Acres)	Additional Storage with Structure (Ac.Ft.)
3	530	125	130	61	140	502
4	9678	110	130	342	1311	16530
5	1620	155	160	225	301	1315
6	1591	174	190	216	497	5704
7	6963	132	140	1234	1413	10588
8	8585	125	130	198	280	1195
9	4250	108	110	105	449	554
10	8557	98	100	234	892	1126
11	17218	88	90	693	1517	2210
12	20627	80	85	228	995	3057
13	12799	95	100	450	1555	5012
14	724	-	80	114	165	-
17	4007	61	65	118	313	862
19	13020	53	55	409	566	975
20	6517	42	45	251	373	942
21	10064	94	100	399	1060	4377
23	-	-	-	883	-	-
24	-	-	-	640	-	-
25	16945	7	10	528	3950	6717
Total				7328	15777	61666

TABLE 7.6 - Potential Impoundment Sites - Streams

Site No.	Drainage Area (sq.mi.)	Stage-Elev. (Ft.MSL)	Surface Area (Ac.)	Storage (Ac.ft.)
1	23.0	20	1900	15100
2	68.0	50	1000	12000
3	84.0	60	2000	33700
4	9.4	60	700	11300
5	24.7	60	1000	16200
6	2.8	60	200	2000
7	26.4	100	400	5600
8	133.6	50	1900	19500
9	9.9	60	400	6000
10	6.0	60	200	2700
11	15.5	60	300	3700
12	3.2	60	200	3500
13	5.1	60	200	3300
14	18.7	25	600	6600
15	8.9	60	400	5500
16	37.0	125	400	3400
17 1/	50.0	110	2500	35700
18	115.4	80	3800	46800
19	31.8	25	400	3600
20	6.1	70	200	2200
21	7.5	70	350	5600
22	29.5	20	200	1200
23	6.0	25	300	1700
24	13.6	20	300	2000
25	92.6	20	1400	8100
26	63.0	18	650	4500
27	32.3	50	3300	21200
Subtotal			25200	282700
Diked Impoundment with Back-pumping				
Wilmington Reservoir	769.7	33-35	35000 2/	350000
Palm Bay Reservoir	203.0	25	10880	92500
Subtotal			45880	442500
TOTAL			71080	725200

1/ Includes George's Lake

2/ Approximately 6600 acres of this is Blue Cypress Lake (Lake Wilmington)

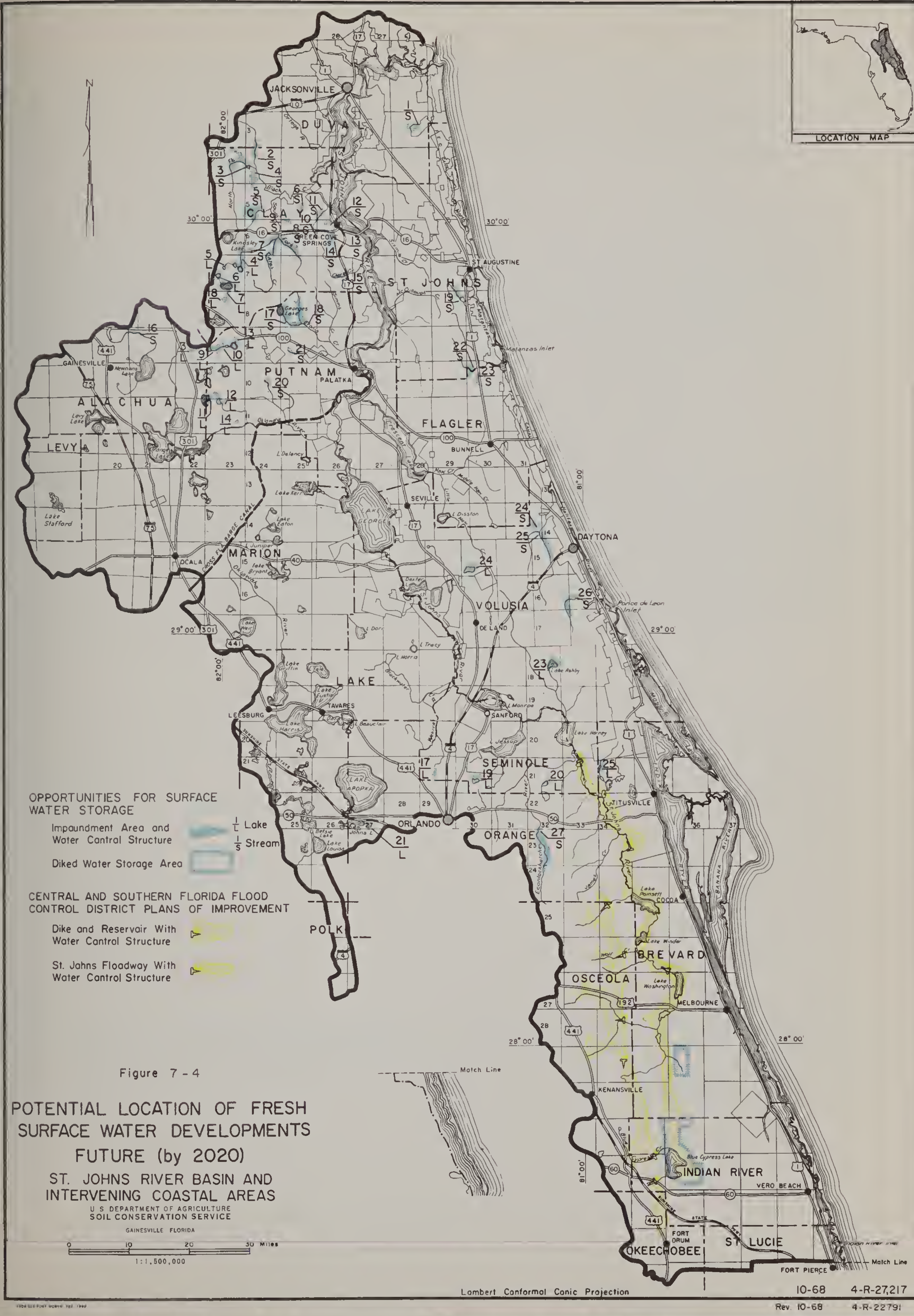

Figure 7-4

POTENTIAL LOCATION OF FRESH SURFACE WATER DEVELOPMENTS FUTURE (by 2020)

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE FLORIDA

Agricultural Impacts

Florida's farmers presently supply more than 75 percent of the nation's market for 21 commodities during certain periods of the year. The potential market for goods produced in the State is growing at an unprecedented rate. Demand for citrus products and vegetables continues to climb. Studies indicate that by 1980, the demand for food produced in Florida will be about twice as great as in 1960.

Florida's ability to compete with other areas in agriculture will depend primarily upon two factors: (1) intensification of agricultural land use, and (2) the amount and quality of water supplies available for agricultural purposes. The 1964 DARE Report contains the following statement concerning the need for water resource development: "Probably the most widespread problem is the lack of information or, in fact, possession of misinformation concerning Florida's water resources on the part of people generally. There is a definite limit to the extent of water resources, contrary to the popular belief that Florida has an inexhaustible supply. A principal problem is one of achieving flood control without contributing to future water shortages or salt water intrusion -- the immediate need is to acquire land to provide artificial storage on submarginal land comparable to that originally provided by nature."[1/]

Throughout this analysis, focus was placed upon national production requirements and developing a means whereby Basin producers could supply their share of needed production. A conscientious effort was made to develop reasonable estimates of future demand for the Basin. Parameters set at the national level were rigidly adhered to. Regional development at the expense of other regions has not been an objective of this study.

Much emphasis was placed upon solutions to local water problems, particularly in the area of providing water storage and improving water quality. Unless water quality is improved through the development of new water supplies, residents along the coast and in the Upper St. Johns Area will continue to face water shortages with the problem becoming more critical as time passes.

Thirty-seven of the Basin's 86 planning units contain projects which are feasible or marginal for development within the next 10 to 15 years. Included in this group are all planning units having benefit-cost ratios of 0.8 to 1 or better. The purpose of this section is to quantify the combined physical and primary economic impacts of these 37 planning unit proposals, as well as potential developments of other Federal and local agencies.

1/ The DARE Report, University of Florida, Institute of Food and Agricultural Sciences, Gainesville, Florida, 1964, pg. 182.

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Several Corps of Engineers projects will affect land use by 1980. Consequently, to keep estimates of resource development as accurate as possible, land use changes resulting from four Corps projects were measured. Results are shown in Table 7.7 in the 1980 column indicating anticipated land use without USDA proposals. The largest Corps project, the Cross-Florida Barge Canal, will inundate an estimated 32,500 acres of Basin forestland when completed. Of this area, 3200 acres are National Forest land. The remaining three works are expected to inundate about 18,400 acres in the area of Lake Poinsett, Taylor Creek and Cox Creek. These effects are shown in the section on land use only. No evaluation of impacts of Corps projects on agricultural production or farm income was attempted.

Land and Water Development

Three sets of data are presented in Table 7.7: (1) 1965 land and water area, (2) anticipated 1980 use assuming a continuation of existing trends in resource development, increased yields, and production (without program), and (3) expected growth assuming accelerated land and water development (with USDA proposals to satisfy needs). With the exception of fresh vegetables, the proposals for land and water use, with the program, provide a means whereby the Basin can provide its share of agricultural production.

Unless the rate of water resource development is accelerated, the Basin may be expected to fall short of its share of needed citrus and vegetable production. This "share" represents 25 percent of the Nation's citrus production, hence the impact of failure to provide for agricultural water needs would be widespread. Problems arise in attempting to shift citrus production. To the north of the Indian River citrus area, well drained soils are available but the risk of freeze damage is high. Most well drained soils with a favorable climate are utilized already. Consequently, a majority of soils available for new citrus plantings are those classified as having excess water hazards. This land would require extensive water management measures to make it suitable for intensified agricultural purposes. To add to the problem, urban water shortages along the coast are expected to become more critical. Fresh water storage must be provided if an atmosphere conducive to sustained agricultural and economic growth is to be maintained south of Cape Kennedy.

Implementation of USDA proposals in the 37 feasible and marginal planning units would help alleviate this water shortage by providing an additional 48,000 acres of fresh water storage (Table 7.7).

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TABLE 7.7 - Impact of Proposed USDA Resource Development Projects on Land and Water Use, St. Johns River Basin

Land and Water Area	1965 Conditions	Project Evaluation: Without program1/ 1980	With USDA Proposals 1980	With USDA Proposals By 2020
	Thousand acres			
LAND				
Cropland:	(533.4)	(565.4)	(590.2)	(772.6)
Citrus	357.2	389.0	400.8	546.4
Vegetables	38.5	37.7	43.1	60.2
Potatoes	30.2	39.3	43.1	37.0
Other Crops	107.5	99.4	103.2	129.0
Improved Pasture	634.7	707.4	789.5	1084.1
Unimproved Pasture	707.2	582.4	492.3	69.7
Forestland:	(3,514.5)	(3,366.6)	(3,260.2)	(2,772.6)
Private	3,140.9	2,993.0	2,886.6	2,392.0
Federal	373.6	373.6	373.6	380.6
Miscellaneous	515.8	441.3	415.7	271.0
Total agricultural	5,905.6	5,663.1	5,547.9	4,970.0
Reserve Area	28.5	28.5	96.6	156.1
Urban and Built-up	687.4	879.0	878.8	1,350.8
Total Land	6,621.5	6,570.6	6,523.3	6,476.9
WATER				
Salt	417.7	417.7	417.7	417.7
Fresh	276.7	327.6	374.9	421.3
Total Water	694.4	745.3	792.6	839.0
TOTAL LAND AND WATER	7,315.9	7,315.9	7,315.9	7,315.9

1/ Anticipated or "normal" rate of resource development assumed to continue. Includes expected development of four Corps projects - Cross Florida Barge Canal, Lake Poinsett (Units 36, 37 and 39), Taylor Creek (Units 39 and 40) and Cox Creek (Unit 40).

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Creation of the Upper St. Johns, Palm Bay, and Spruce Creek Reservoirs would increase fresh water impoundments by 40,000 surface acres, providing an additional 447,000 acre-feet of water storage. Approximately 100,000 acres of citrus and 20,000 acres of grass-clover pasture could be irrigated from the three reservoirs. The creation of these storage sites will require the inundation of 4,500 acres of improved pasture, 7,200 acres of range, 4,900 acres of forestland, and 23,400 acres of miscellaneous agricultural land. With the potential sites indicated in this report, and those of other agencies, total fresh water area could be increased by about 144,600 acres above the existing 276,700 acres.

Total agricultural land area is expected to decline during the next 10-15 years regardless of project installation. By 2020, more than 663,000 acres of agricultural land is expected to shift to urban uses. Proposed projects are not expected to have any appreciable effect upon anticipated urban development, however, with the surface reservoirs as a source of irrigation water, more of the underground supplies could be used to relieve urban water shortages.

With USDA project proposals in place, agricultural land could be utilized more intensively as a result of the reduction of flood damage, improved drainage, and the provision of sufficient irrigation water. With the projects, cropland would be increased from an expected 565,000 acres to 590,000 acres. About one-half of this increase would be used for citrus production. An additional 80,000 acres of improved pasture would be brought into production, much of this pasture coming from the anticipated 100,000 acre reduction in rangeland.

Greater reductions in the forestland acreage will result from land use changes than from areas taken for water storage or water management projects. The loss of forestland due to potential water development projects would be only about 12 percent of the total reduction. Figure 7-5 shows the total loss of forestland to other uses. The greatest rate of change is expected between 1965 and 1980.

Effect on Production

Installation of proposed USDA works should increase citrus production to the level of expected needs and reduce expected deficits in vegetable and beef production (Table 7.8). With no additional water supplies, citrus production cannot be expected to exceed 87 million boxes by 1980. This is probably an optimistic figure in view of current irrigation water shortages. However, with

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CUMULATIVE REDUCTION OF FORESTLAND ACREAGE

St. Johns River Basin and Intervening Coastal Areas

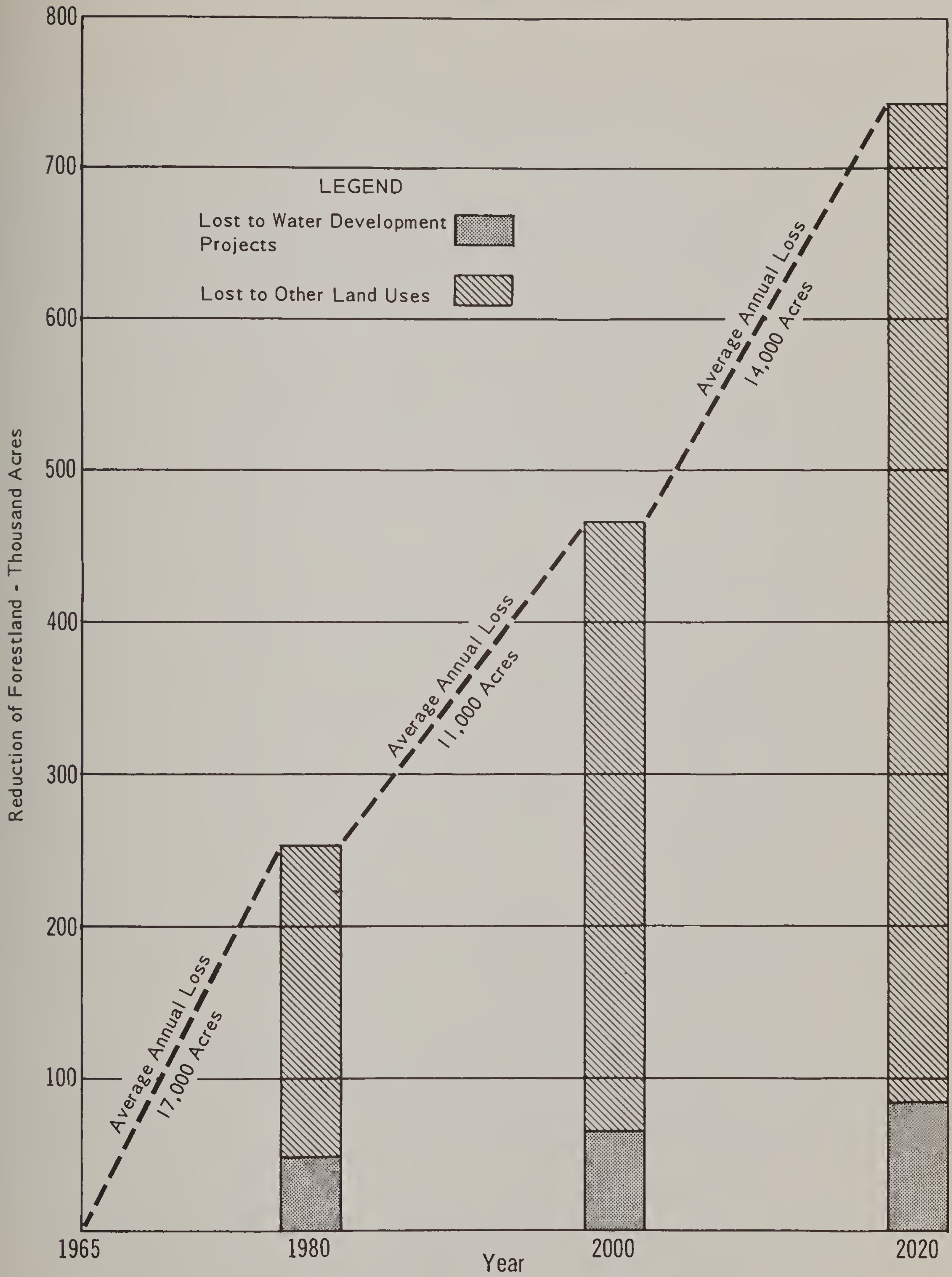

Figure 7–5

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the Upper St. Johns and Palm Bay reservoirs installed, growers could increase production on existing acreages by 6.5 million boxes annually, and produce an additional 5.5 million boxes on land shifting to citrus production in the Indian River area.

Inadequate water supplies will limit the application and resulting impact of future technological improvements. Consequently, average yields with the USDA proposals will be higher than yields without, due to the influence of available water. Citrus yields were assumed to increase by about 30 percent on groves using proper irrigation methods.

Vegetable production (excluding Irish potatoes) has increased in the Basin during the past decade even though acreage has decreased slightly. This trend is expected to continue. By 1980, production should reach about 550 million pounds compared with a projected need for 764 million pounds. The proposed projects would bring an additional 5,400 acres of vegetables into production and increase output to approximately 630 million pounds.

Table 7.8 indicates 162 million pounds of beef and veal are needed from Basin farms by 1980. Florida imports about two-thirds of the beef consumed in the State so the need may be much larger than the share historically indicates. A per capita consumption of 117 pounds per person in 1980 would indicate a need for 283 million pounds to feed the Basin population alone. With no accelerated resource development, beef output is expected to reach 218 million pounds by 1980. With the USDA proposals, production would be increased to 234 million pounds. Of the 16 million pound increase, 7 million would result from irrigation of grass-clover pasture, while the remaining 9 million pounds would come from shifts to other improved grasses not irrigated.

An additional 3,800 acres of hay crops would benefit from improved drainage conditions, increasing total production by 11,000 tons. This is still well below the level of feed units needed to support the Basin's beef cattle industry, hence the area will continue to import a majority of its feed supplies.

It is anticipated that a higher rate of production will be accomplished on fewer acres of forestland due mainly to more intensive forest management. The annual growth will be increased to more nearly that of full potential for forestland and this increased growth will be sufficient to furnish the projected cut for each time frame.

Figure 7-6 shows the projected growth cut from growing stock for 1980, 2000 and 2020 and the needed growth and growth per acre of growing stock to supply the required cut. The growth rates appear to be reasonable and it is estimated that they can be attained through more intensive forest management.

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TABLE 7.8 - Impact of USDA Proposals Upon Agricultural Production, With and Without Accelerated Resource Development, 1980

Item	Unit	Share or "need" in 1980	1980 Output: Anticipated production without program	1980 Output: With USDA proposals to meet needs
Affected by projects				
Citrus:	Mil. boxes	(97)	(87)	(98)
Oranges	"	69.9	63	71
Grapefruit	"	24.9	21	24
Tangerines	"	2.6	3	3
Vegetables:	Mil. lbs.	(764)	(551)	(629)
Fresh	""	628	468	534
Processing	"	136	83	95
Irish Potatoes	"	423	880	970
Hay	Thou. tons	63	150	161
Beef and Veal	Mil. lbs.	162	218	234
Not Affected				
Corn	Thou. bu.	440	1000	1000
Peanuts	Mil. lbs.	2.3	3.2	3.2
Pork	Mil. lbs.	6.5	7	7
Milk	Mil. lbs.	500	500	500
Poultry	Mil. lbs.	35.6	37	37
Eggs	Mil. doz.	40.5	50	50

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PROJECTED CUT FROM GROWING STOCK
AND
GROWTH NEEDED TO MAINTAIN PRESENT GROWTH – CUT RATIO
St. Johns River Basin and Intervening Coastal Areas

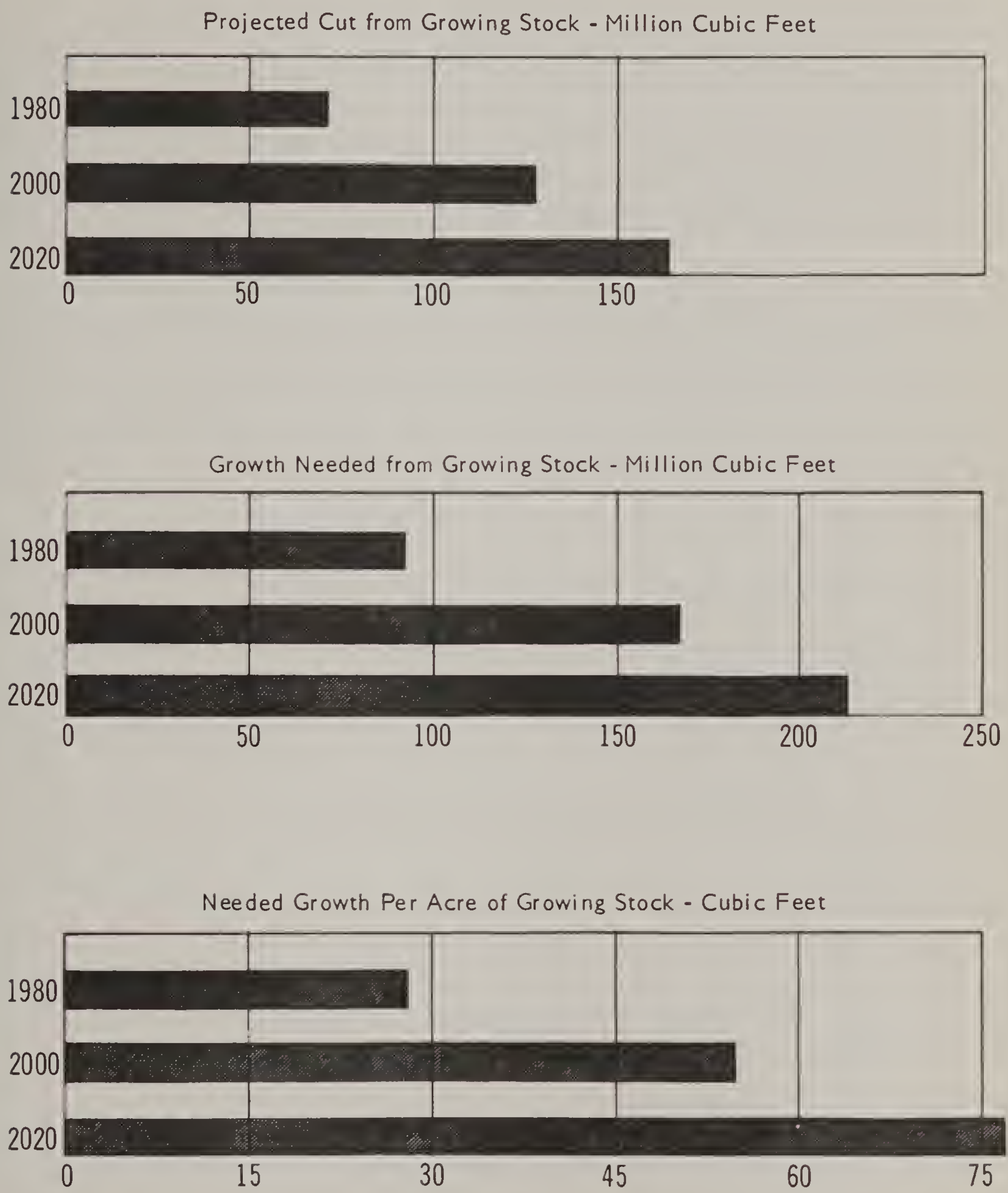

Figure 7–6

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Economic Impact

The proposed works of improvement should result in an increase in the gross value of farm production of about $29 million annually by 1980, bringing the total value of output to $380 million (Table 7.9). Two-thirds of the increase of $18.5 million, would be from the sale of citrus products. Vegetable income should increase by about $5 million with a similar increase from the total of other commodities. If Basin production needs are supplied, the value of output should approach $600 million by 2020.

Values were computed using interim prices shown in the Technical Appendix. A price of $1.26 per box was assumed for oranges. This figure is low when compared with the 1960-1965 average of $2.91, but it is in line with anticipated future orange prices. Current production costs for oranges average $0.70 to $0.90 per box, hence grove owners must concentrate on increasing efficiency of production if profits are to be substantially increased.

TABLE 7.9 - Gross Value of Agricultural Production, 1980, With and Without Accelerated Development

Commodity	Without Accelerated Resource Development	With USDA Works of Improvement
	----------Million dollars----------	
Production Affected		
Crops:		
Citrus	150.5	169.0
Vegetables	31.6	36.3
Irish Potatoes	25.3	27.8
Hay and forage	5.1	5.4
Livestock:		
Beef and veal	43.1	46.3
Sub-total	255.6	284.8
Not Affected		
Crops	37.1	37.1
Livestock	58.1	58.1
TOTAL VALUE	350.8	380.0
Value resulting from project installation	--	29.2

Total installation costs for the 37 feasible and marginal projects evaluated to meet immediate needs would be an estimated \$72 million. Annual costs, including operation and maintenance of facilities, would be about \$4.4 million of which \$2.7 million would be for works primarily associated with construction of the Upper St. Johns Reservoir. Annual benefits are estimated to be \$7.8 million.

The total installation cost for six additional feasible and marginal projects evaluated to meet the needs by 2020 would be an estimated \$5.6 million. Annual costs and benefits for these projects are estimated to be \$0.3 million, and \$0.9 million respectively.

The capital required for land development including USDA proposals to meet needs by 1980 would be about \$60 million and would exceed \$200 million by the end of the planning period (Table 7.10). Not all of this development will result directly from USDA proposals. If the current growth rate continues, it is expected that about \$37 million will be invested in agricultural land development regardless of accelerated water resource planning; however, this level of development will not provide the desired output. Installation of the USDA works would increase capital needs \$23.9 million by 1980. A majority of the cost would be for conversion of various land uses to citrus groves in the Upper St. Johns Area. It was assumed that most of the newly developed citrus groves in the Basin would utilize some type of irrigation system. Of the \$59.9 million necessary for land conversion by 1980, approximately \$10 million would be for land clearance, \$30 million would be allocated for soil preparation and initial planting, and the remaining \$20 million would cover costs for the required irrigation systems. The two most costly operations would be clearance of land for improved pasture (\$7.8 million) and provision of citrus irrigation systems (\$15.3 million).

The consequences of failure to provide additional water storage, adequate drainage, and flood control are numerous and costly. Perhaps most serious would be the threat to the citrus industry in the Indian River area. At present an estimated 10 to 15 percent of the nation's citrus products are supplied from groves in Brevard, Indian River, and St. Lucie counties. Additional water for irrigation is already critically needed. This is also the location of most rapid urban growth. With non-agricultural water withdrawals increasing, there is little hope for expanding the current level of citrus output in the Upper St. Johns area. Sustaining the current level of output will probably be difficult. Consequently, with no additional water storage and a lack of adequate water management systems, yields will suffer. Land developed for agricultural use will have to be increased if the Basin's share of production is to be supplied. Under these conditions, it is estimated that between 1965 and 1980, approximately 176,000 acres of cropland and improved pasture would have to be developed compared to 107,000 acres with the USDA proposals. This is shown in Table 7.11.

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TABLE 7.10 - Capital Requirements for Land Development, St. Johns River Basin - 1965 to 2020

Land Development	Capital Investment 1980 Mil.Dol.	%	2020 Mil.Dol.	%
Citrus 1/	33.8	56.4	146.6	66.4
Vegetables 2/	4.4	7.4	7.1	3.2
Improved Pasture 3/	21.7	36.2	62.9	28.5
Other Crops	-	-	4.3	1.9
Total	59.9	100.0	220.9	100.0
Capital need resulting from USDA proposals	23.9	-	-	-

1/ Estimated development cost - $775 per acre
2/ Estimated development cost - $250 per acre
3/ Estimated development cost - $140 per acre

TABLE 7.11 - Cropland and Pasture Needs and Costs Necessary to Supply the Expected Level of Production, 1980, With and Without the USDA Proposals

Item	Conditions Anticipated Assuming Current Trends (Short of Production Needed)	Additional Land to Reach Needed Level of Production: Without USDA Proposals	With USDA Proposals
	------Thousand acres------		
Cropland:			
Citrus	389.0	49.6	11.8
Vegetables 1/	77.0	9.2	9.2
Other crops	99.4	4.4	3.8
Improved Pasture	707.4	113.0	82.1
Total	1,096.4	176.2	106.9
Capital for Development	--	$46.8 mil.	$23.9 mil.
Capital Savings	--	--	$22.9 mil.
Land released for other uses	--	--	69,300 ac.

1/ Includes Irish Potatoes

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Implementation of works suggested by USDA for immediate needs (by 1980) should result in development cost savings of $23 million and the release of 69,000 acres of land for other uses, in addition to providing an adequate water supply, drainage, and flood control structures.

Primary beneficiaries of the drainage and flood prevention features of the proposed projects would be producers of citrus, vegetables, and beef cattle within these project areas. The majority of the irrigation benefits will accrue to growers and ranchers in the Upper St. Johns Area.

In addition to benefiting agricultural interests, several of the proposed canals will improve drainage in urban areas, thus enhancing urban land values. For instance, the Palm Bay canal system should benefit urban land owners around the cities of Melbourne and Palm Bay. The magnitude of this benefit was not estimated however.

Works of improvement proposed by USDA would help satisfy the increasing demand for water oriented recreational facilities. Sites near population centers could provide over two million user days of recreation annually. Potential secondary impacts from the proposed resource developments could be widespread, considering the interrelationships between the farm and non-farm sectors. Employment will be stimulated as a result of project installation. Construction, operation and maintenance facilities will provide many man years of employment for both skilled and unskilled labor.

Employment attributed to the forest resource and forest-based industries will decline between 1965 and 1980, but an increase is anticipated between 1980 and 2000 due to greater numbers of personnel in management positions and an increased activity in pulpwood production. A slight increase is expected in management personnel after 2000, but the number of workers producing pulpwood, lumber and other wood products will probably be reduced due to more efficient methods of harvesting and other mechanization.

The total payrolls for those working in forestry related activities will increase during each time frame due to higher wage rates, even though there will be fewer employees in 1980 and by 2020 than in 1965.

The anticipated increase in the production of wood products will yield more in stumpage value to forestland owners. The expected increases in income and production will result in a greater total impact of the forest resource and forest-based industries on the economy of the Basin. The present and projected employment, income, stumpage value and total impact of the forest resource and forest-based industries are shown on Figure 7-7.

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PRESENT AND PROJECTED EMPLOYMENT, STUMPAGE VALUE, INCOME, AND TOTAL IMPACT OF THE FOREST RESOURCE AND FOREST- BASED INDUSTRIES

St. Johns River Basin and Intervening Coastal Areas

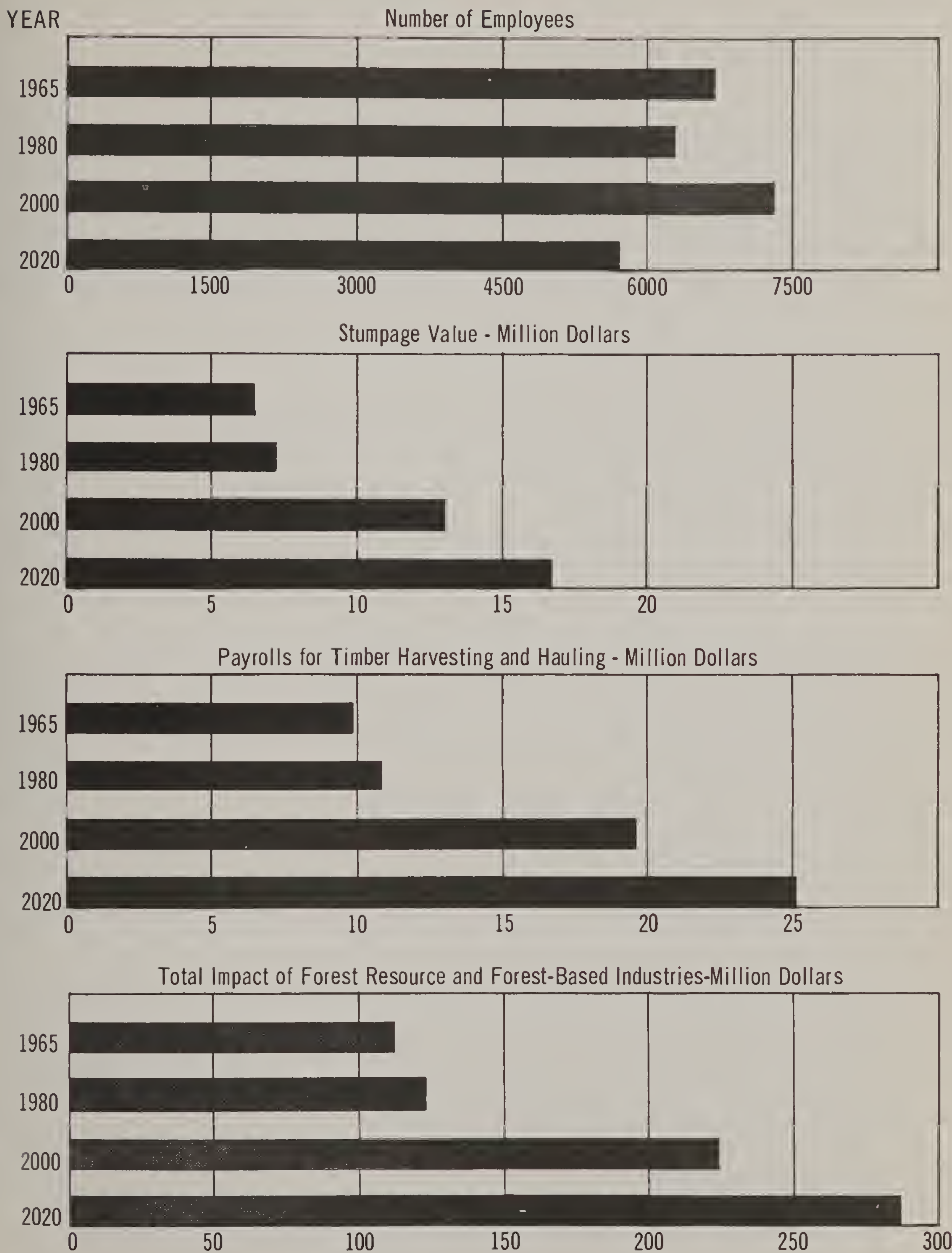

Figure 7–7

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SECTION VIII

COORDINATION AND PROGRAMS FOR FURTHER DEVELOPMENT

The Florida Board of Conservation through the Water Resources and Conservation Division has the responsibility for coordinating efforts of the state and federal agencies involved in the study of land and water resource use and management. They also will prepare, print and distribute a comprehensive report for the Basin from data collected by them and submitted to them by cooperating state and federal agencies.

Alternatives

Development potentials suggested in this report, based on satisfying projected needs for products, space, services, and other considerations, are in keeping with sound conservation principles as they are recognized at this time. It is obvious that use and development could proceed in some random manner without regard to other developments or the consequences that could result through a non-coordinated approach.

Development of costs and benefits for the individual planning units took into consideration the immediate and future needs for products. The projected product needs in terms of acres of land resources required were allocated to the individual planning units within the Basin for the two time frames. The allocation was predicated on prior use, ownership, climatic considerations, soil capabilities and physical hazards involved in the continued use, production, and improvement of the soils. The desired objective is to give the local people and concerned local, state or federal agencies, the best estimates possible as to the costs and anticipated benefits from resource development.

One alternative would be to disregard the works of improvement set forth in this report and to rely upon non-coordinated future development. To do so would be quite hazardous and costly, particularly to the citrus industry. As was pointed out earlier in the discussion of impacts, trends indicate that production in 1980 will fall short of the necessary level if this course of action is followed. With no coordinated system of water control and storage, marginal land will be brought into production and crops dependent upon irrigation will suffer reduced yields resulting in increased land needs, higher production costs, and the continued risk of crop damage due to flooding and poor drainage. The USDA proposed system of works should provide the desired level of output to meet 1980 needs with a savings of about 69,000 acres and $16 million.

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Alternative considerations evaluated in developing proposals for specific projects are stated in some detail in the individual Watershed Investigation Reports included as a part of the Planning Unit Appendix.

In making the overall land use projections for future needs, 127,000 acres were deducted from the agricultural land base and designated as reserve area (Table 6.1). This reserve area was added to the existing 29,000 acres of camp sites, parks, and other areas of special use making a total of 156,000 acres set aside for special purpose uses. No attempt has been made to enumerate or evaluate the alternative uses that may or could be made of this land area. If no special use is made of these areas, much of the land can, and probably will be used for agriculture.

The total acreages of forestland in the Basin listed for each time frame, are the acreages depended upon for timber production. Acreages of forestland expected to be used as special service areas were considered in the above mentioned reserve areas and taken from the agriculture base. If more area is needed for uses other than timber production than was anticipated, growth of forest products will be reduced. The development of forestland by private owners for recreation or wildlife rather than for timber production will also result in reduced growth of raw material for forest-based industries. The deficiencies in growth of forest products resulting from any cause or combination of causes will have to be met from areas outside the Basin.

Forestland areas maintained within, and adjacent to centers of population assure that some ground water recharge areas are maintained to counter the loss that results from urbanization. These forestland areas can be used for recreation and wildlife habitat. Acreages being held for future subdivisions can be planted with trees for natural beauty, shade and watershed protection.

Other Agency Programs

The Corps of Engineers, Department of the Army, has authorizing resolutions and acts covering works of improvement and proposed works within the Basin. The authorizations having the greater influence on resource use and development are the Oklawaha River - Four River Basins Project, the Cross-Florida Barge Canal, and the Central and Southern Florida Flood Control Project. Details of the projects are covered in the comprehensive Corps of Engineers reports for the respective projects. The general locations of the existing or proposed works of improvement are indicated on Figure 8-1.

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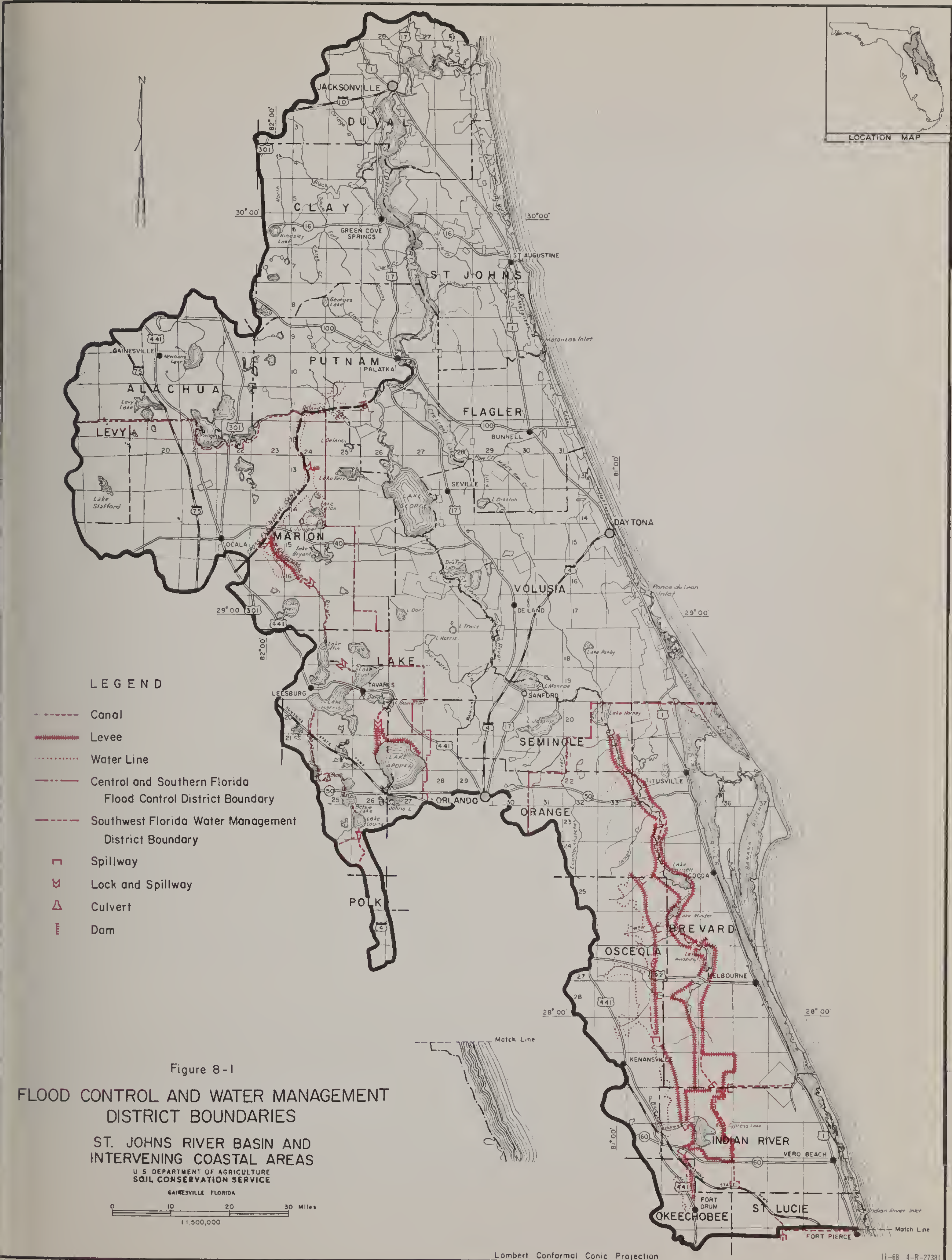

Figure 8-1

FLOOD CONTROL AND WATER MANAGEMENT DISTRICT BOUNDARIES

ST. JOHNS RIVER BASIN AND INTERVENING COASTAL AREAS

(Formerly 2-P-10,999)

Rev. 10-68 4-R-22791

Active drainage districts and mosquito control districts, authorized under State statute, are located in the Basin and have projects in operation.

Potential Developments Needing Further Coordination With Other Agencies

Existing and proposed USDA activities in the Basin often require coordination with projects of the Corps of Engineers and Flood Control District, since these projects provide major outlets which are necessary for proper operation of USDA works. Continued cooperation is essential among all agencies involved in soil and water resource conservation activities to assure mutual success of the various works of improvement.

Works of improvement proposed in the Investigation Reports for the Upper St. Johns River and Intervening Coastal Area, and the Palm Bay Planning Unit, will require close coordination with the Central and Southern Florida Flood Control District; the individual drainage districts represented within the areas; the respective county governing bodies of Brevard, Indian River, St. Lucie, Okeechobee and Osceola counties; and the soil and water conservation district supervisors of the above named counties. Some of the project proposals in the Investigation Reports, included as a part of the Planning Unit Appendix, exceed size limitations imposed by Public Law 566.

The development of sites along streams (Figure 7-4) for impoundments of fresh surface water is dependent on implementation by authorities other than Public Law 566. The majority of the sites are in areas of forestland that are expected to remain in timber (timber company or other large forestland ownership). A number of the sites would provide storage larger than allowable under Public Law 566 (Table 7.6). Present damageable values downstream from the sites are low and would produce only minor flood reduction benefits. Development of most of the sites would necessarily be for recreational purposes for the forseeable future.

A need for land and water areas for recreational purposes was recognized in the process of projecting future resource use. However, since the request from the sponsoring State agency, the Florida Board of Conservation, to the U. S. Department of Agriculture was for a study and report on the agricultural aspects of land and water resources, no attempt was made to do more than recognize this need and indicate likely areas that have a potential for future recreational development (Table 6.1 and Figure 6-7).

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TECHNICAL APPENDIX

To Report Of

ST. JOHNS RIVER BASIN

AND

INTERVENING COASTAL AREAS

1969

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SECTION A

ECONOMIC INVESTIGATIONS

<u>General Assumptions and Acknowledgements</u>

The planning process involving projections into the future requires that assumptions be made concerning national, regional, and local economic growth. The major assumptions are specified in Section 4 of the main report in the discussion of future commodity needs. The most important of these assumptions is that our national output will continue to grow with no major depression or other disruptive occurrence such as a world war to seriously affect the trend of economic development.

Employment and income projections are based in part, upon national growth estimates prepared by the Office of Business Economics, United States Department of Commerce (OBE), and by the Economic Research Service, United States Department of Agriculture (ERS). Population projections for the State of Florida and Basin counties were provided by the Florida Development Commission.

Taking into account these assumptions, the planning objective becomes one of satisfying an expanding population's food and fiber needs at a reasonable cost to society and, at the same time, taking into account the fact that the agricultural land resources will be diminishing due to conversion to other uses.

Many sources of information were consulted in the course of the economic analyses. These include national policy guides for river basin studies; economic handbooks and manuals, published and unpublished historical data and projections of Federal, State, and private agencies.

Among the more important references were:

(1) "Preliminary Projections of Economic Activity in the Agricultural, Forestry and Related Sectors of the United States and its Water Resource Regions, 1980, 2000, and 2020".

(2) <u>United States Census of Agriculture - Florida</u>, 1939-1964

(3) <u>United States Census of Population - Florida</u>, 1940-1960

(4) <u>The DARE Report</u>, An Analysis of Florida's Agriculture to 1975, published by the Florida Agricultural Experiment Station

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(5) "Dimensions", a monthly publication of the Bureau of Economic and Business Research, University of Florida

(6) "Interim Price Standards for Planning and Evaluating Water and Land Resources", adopted by the Water Resources Council for use in river basin planning

(7) Numerous commodity reports published by the Statistical Reporting Service (SRS) in Orlando.

Consultations with members of the staff of Florida Agricultural Experiment Stations were of particular help throughout the study.

An indication of the future magnitude of the national economy was provided by the water resources regional projections developed by the Office of Business Economics, United States Department of Commerce. These estimates shown below, serve to specify projected national commodity needs and ultimately influence the degree and location of resource development planned at the Basin level.

TABLE A-1. - National Economic Framework, United States

Item	Unit	1960	1980	2000	2020
Population	Mil.	180.7	245.3	338.2	469.1
Employment	Mil.	66.4	94.8	130.6	181.2
Gross national product	Bil.Dol.	440	1,001	2,144	4,686
Per capita income	Dol.	1,955	3,200	4,967	7,738

Source: Office of Business Economics, U. S. Department of Commerce

Trends in the output of individual commodities were analyzed carefully in determining the State's future agricultural production needs. Once Florida's projected share of national output was derived, attention was focused on determining the percentage of Florida production that could be expected from farms in the Basin. This involved a detailed study of the agricultural economy of the Basin in relation to general agricultural development in the State. A share of Florida's anticipated production needs was then allocated to the Basin on the basis of historical production and the anticipated availability of land and water resources for agricultural production within the Basin.

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The framework for commodity projections included: (1) a joint study of the Office of Business Economics, U. S. Department of Commerce, and the Economic Research Service, U. S. Department of Agriculture, which estimated future national agricultural needs, both domestic and export; (2) established Basin production trends for the 1939-1965 period in relation to production in Florida and the United States; and (3) consultation with agricultural specialists familiar with the State's agricultural development and problems.

Population and Urban Land Requirements

Population projections for both Florida and individual counties within the St. Johns River Basin were provided by the Florida Development Commission through the Florida Board of Conservation. Population estimates for those counties not entirely within the Basin were made through the use of United States Census of Population county division maps which locate population within small sub-areas of a county.

The Basin's population was projected to have an increase of about one million persons by 1980. Ninety percent of the future increase was assumed to occur in urban areas. By 2020, Basin population was estimated to be 90 percent urban.

Urban lands and built-up areas were defined as those areas which include space for housing, business, industry, highways, roads, railroads, other rights-of-way, golf courses, airports, cemeteries, and city parks.

Urban land needs were estimated and deducted from the future land base prior to the allocation of land for agricultural purposes. Consideration was given to population densities by size of place, the trend to urbanization, the historical increase in density of population as population increases, and the current and projected distribution of population within the Basin. Urban and built-up area per capita was estimated at 0.39 acres in 1965 and was projected to 0.30 acres in 1980 and 0.16 acres in 2020.

Densities assumed for 1980 ranged from a high of 8,000 persons per square mile in the central city of Jacksonville to as low as 500 persons per square mile in several sparsely populated areas.

Citrus

Per capita utilization of citrus products is projected to increase from 84 pounds in 1965 to 102 pounds by 1980 and thereafter. Utilization, not to be confused with per capita consumption, includes export

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needs as well as domestic consumption. Total United States demand for citrus is expected to reach 25.1 billion pounds by 1980 and 48 billion pounds by 2020.

Florida's contribution to national citrus production was projected to increase to 77 percent for all target years. Trends for the Basin indicate that it can be expected to supply about 44 percent of Florida's total citrus output in 1980, level off at 45 percent in 2000, and continue at this level to 2020.

It was assumed that citrus yields would increase by 30 percent with proper irrigation. Average Basin orange yield in 1965 was 250 boxes per acre. With an effective system of water management, yields were assumed to increase to 280 boxes per acre by 1980 and 400 boxes by 2020. One acre out of every five was assumed to be non-bearing.

Vegetables

National demands for vegetables, particularly fresh, are expected to increase rapidly throughout the study period as a result of rising per capita use, coupled with a larger market. A 25 percent increase in per capita utilization is anticipated by 1980.

Florida normally supplies about 6 percent of the nation's vegetables and melons; little change in this share is expected in the future. Production will continue to be primarily for the fresh market.

The share of Florida's vegetable and melon output coming from Basin farms is projected to be 23 percent in the future - 12 percent of the fresh market supply, 50 percent of the vegetables for processing, and 75 percent of all Irish potatoes.

Livestock

This study is oriented toward land and water development needs, consequently primary emphasis was upon beef production rather than upon livestock enterprises less dependent on land use. Dairy operations, it is assumed, will continue a transition toward feedlot management of herds with some supplemental grazing.

The greatest potential for increased beef production in Florida lies in pasture improvement and management. It is assumed Florida cattlemen will continue to improve existing pastures and develop

additional improved pasture from range lands. A nominal increase in Florida's share of national beef and veal output is anticipated. About 19 percent of Florida's output is expected to be produced in the St. Johns Study area.

Several assumptions were made concerning changes in the composition of the industry. Among the more important were the following: (1) Eighty percent of the beef and veal required in the future will be grass fed; (2) Of the grass fed beef, 80 percent in 1980 and 90 percent in 2000 and 2020 will come from improved pastures; and (3) Twenty-five percent of the improved pasture will be clover-grass mixtures by 1980, 30 percent by 2000 and 35 percent by 2020.

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TABLE A-2. - Total Population of the United States, Florida, and the St. Johns River Basin, 1965, and Projected to 1980, 2000 and 2020

Area	Base 1965	Projected 1980	2000	2020
	-----------------	Thousand	-----------------	
United States:1/	193,800	245,300	338,200	469,100
Florida:2/	5,805	8,907	17,648	26,362
St. Johns Basin:	1,487	2,421	4,448	6,585
Alachua*	70	121	246	369
Broward	192	411	960	1,440
Clay	20	26	39	58
Duval*	503	671	1,018	1,323
Flagler	6	10	78	157
Indian River	32	66	186	325
Lake*	58	97	119	179
Marion	50	89	192	335
Okeechobee*	1	2	15	38
Orange*	253	360	691	1,036
Osceola*	1	2	5	9
Putnam	33	76	106	150
Seminole	70	152	314	502
St. Lucie*	7	14	32	47
St. Johns	33	48	76	98
Volusia	158	276	371	519

1/ OBE-ERS joint projections accepted by the Water Resources Council for use in river basin studies.

2/ Projections for Florida and individual Basin counties were prepared by the Florida Development Commission for the Florida Board of Conservation.

* Indicates population only in that portion of the county which lies within the boundaries of the Basin. Polk, Levy, and Sumter counties are not listed due to the small population involved.

TABLE A-3. - Urban and Built-Up Land Area, 1965 and Projected to 1980, 2000 and 2020, St. Johns River Basin, Florida

County	Base 1965	Projected urban land need 1980	2000	2020
		(A c r e s)		
Flagler	3,968	5,760	17,600	24,000
Seminole	22,080	38,400	55,000	68,000
St. Lucie	4,480	8,060	12,800	14,000
Brevard	84,224	108,860	162,800	194,000
Orange	50,496	70,780	104,700	132,000
Marion	19,904	25,090	36,600	49,000
Alachua	28,800	33,020	47,900	55,000
Lake	24,832	34,500	36,000	45,000
Putnam	23,488	36,540	41,800	45,000
Indian River	35,200	42,940	54,900	61,000
Clay	14,592	16,580	19,200	22,000
Volusia	80,768	101,950	110,500	122,000
St. Johns	19,200	22,660	25,500	27,000
Duval	158,976	175,360	200,900	210,000
Okeechobee	1/	2,690	8,800	12,000
Osceola	1/	2,560	4,600	6,000
Total	571,008	725,750	939,600	1,086,000

1/ Less than 100 acres

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TABLE A-4. - Citrus Production and Acreage Needs, 1965 and Projected to to 1980, 2000 & 2020, United States, Florida & St. Johns River Basin

Item	Base 1965	Projected need 1980	2000	2020
United States:				
Product needs[1/]				
Per capita, lbs.	84	102	102	102
Total, mil. lbs.	16,200	25,100	34,600	48,000
Florida:				
Share of U.S., citrus production, percent	68	77	77	77
Production needs, mil. lbs.	10,980	19,500	26,800	37,100
St. Johns Basin:				
Share of Florida citrus production, percent	42	44	45	45
Production needs, mil. lbs.	4,500	8,650	12,000	16,600
Citrus yield, lbs. per bearing acre	20,070	26,600	32,200	37,500
Citrus acreage needs				
Bearing, thou. acre	270	325	373	443
Non-bearing, thou. acre	87	76	87	103
Total acreage needs, thou.	357	401	460	546

1/ Total needs for all purposes, including exports

TABLE A-5. - Data Relative to Land Needs for Vegetable, Melon, and Potato Production, 1965, and Projected to 1980, 2000 & 2020, United States, Florida, & St. Johns River Basin

Item	Base[1/] 1965	Projected 1980	Projected 2000	Projected 2020
United States:				
Population, mil.	194	245	338	469
Per capita utilization[2/]				
Vegetables and melons, lbs.	203	259	259	258
Potatoes, lb.	149	142	143	143
Total	352	401	402	401
Total production and needs				
Vegetables and melons, mil.lbs	39,300	63,545	87,618	121,150
Potatoes, mil.lbs.	28,900	34,709	48,368	67,065
Total, mil.lbs.	68,200	98,254	135,986	188,215
Florida:				
Share of U.S. production				
All vegetables & melons, percent	6.0	6.6	6.7	6.2
Vegetables and melons, percent	8.8	8.7	8.8	8.2
Potatoes, percent	2.1	2.8	2.8	2.6
Production and needs				
Vegetables and melons, mil.lbs.	3,458	5,506	7,741	9,976
Potatoes, mil.lbs.	608	968	1,348	1,728
Total, mil. lbs.	4,066	6,474	9,089	11,074
St. Johns Basin:				
A. Share of Florida's production				
All vegetables, melons and potatoes, percent	22	23	23	23
Vegetables and melons				
Fresh market, 3/ - percent	12	12	12	12
Processing 4/, percent	43	50	50	50
Potatoes, percent	68	75	75	75
B. Production and Needs				
Vegetables and melons				
Fresh, mil. lbs.	393	628	882	1,137
Processing, mil.lbs.	86	136	194	252
Potatoes, mil.lbs.	423	726	1,011	1,296
Total, mil.lbs.	902	1,490	2,087	2,685

See footnotes at end of table

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TABLE A-5 (Continued) -

Item	Base 1/ 1965	Projected 1980	2000	2020
St. Johns Basin:				
C. Yields per acre				
Vegetables and melons				
Fresh, lbs.	12,500	15,500	20,200	24,900
Processing, lbs.	9,500	10,100	13,700	17,300
Potatoes, lbs.	15,000	22,500	30,000	35,000
D. Land needs				
Vegetables and melons				
Fresh, acres	31,400	40,600	43,700	45,600
Processing, acres	9,100	13,400	14,200	14,600
Potatoes, acres	28,200	32,200	33,700	37,000
Total, acres	68,700	86,200	91,600	97,200

1/ 1966 U.S. Agricultural Statistics and Florida Vegetable Summary, 1966, Crop Reporting Service, Orlando, Florida

2/ Total U.S. needs, not limited to domestic consumption

3/ Lima beans, cabbage, celery, escarole, lettuce, strawberries, eggplant, squash, sweet corn, green peppers, cantaloupes, and watermelons.

4/ Tomatoes, snapbeans, cabbage and spinach

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TABLE A-6. - Data Relative to Need for Improved Pasture Land for Beef and Veal Production, 1965 and Projected to 1980, 2000 and 2020, United States, Florida, and St. Johns River Basin

Item	Base 1965	Projected 1980	2000	2020
United States:				
Population, mil.	194	245	338	469
Production need				
Per capita, lbs. (live wt.)	171	194	194	194
Total, mil.lbs. (live wt.)	33,328	47,520	65,519	90,879
Florida:				
Share of U.S. beef, percent	1.3	1.7	2.0	2.3
Production, mil.lbs. (live wt.)	426	808	1,310	2,090
St. Johns Basin:				
Share of Florida beef production, percent	19	19	19	19
Total production, mil.lbs.	81	154	249	397
Grass fed 1/ mil.lbs.	71	123	199	318
On improved pasture, mil.lbs.	47	100	179	286
Clover, mil.lbs.	9	25	54	100
Other improved, mil.lbs.	38	75	125	186
Yields, lbs. per acre (live wt.)				
Grass-Clover	200	310	400	500
Other improved grasses	40	125	190	250
Acreage of improved pasture for beef				
Grass-Clover (1000 acres)	NA	80.6	134.2	200.0
Other improved pasture (1000 acres)	NA	600.0	659.5	744.0
Total (1000 acres)	NA	680.6	793.7	944.0
Improved pasture for other livestock needs (1000 acres)	NA	109.4	126.3	140.0
Total improved pasture (1000 acres)	634.7	790.0	920.0	1084.0

1/ Excludes beef produced by dairy industry.

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TABLE A-7. - Data Relative to Production of Eggs, 1965 and Projected to 1980, 2000, and 2020, United States, Florida and St. Johns River Basin

Item	Base 1965	Projected 1980	2000	2020
United States:				
Egg requirement				
Per capita, number	338	309	308	307
Total, mil. eggs	65,692	75,778	103,994	144,172
Florida:				
Share of U.S. egg production, percent	2.4	3.5	4.0	4.0
Production, mil. eggs	1,599	2,650	4,200	5,800
St. Johns Basin:				
Share of Florida egg production, percent	22	23	24	24
Production need, mil. eggs	360	600	1,000	1,400
Annual production per layer, eggs	230	250	275	290
Layers required, thousand	1,565	2,400	3,636	4,828

TABLE A-8. - Data Relative to Pork Production, 1965, and Projected to 1980, 2000, and 2020, United States, Florida and St. Johns River Basin

Item	Base 1965	Projected 1980	Projected 2000	Projected 2020
United States:				
Pork production need				
Per capita, lbs.	94	98	98	98
Total, mil. lbs. (live wt.)	18,221	23,959	33,034	45,821
Florida:				
Share of U.S. Pork production, percent	0.4	0.3	0.25	0.2
Production, mil. lbs. (live wt.)	77	72	83	92
St. Johns Basin:				
Share of Florida production, percent	13 1/	10	10	10
Production, mil. lbs. (live wt.)	10.0	7.2	8.3	9.2

1/ 1964 share

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TABLE A-9. - Data Relative to Milk Production, 1965 and Projected to 1980, 2000 and 2020, United States, Florida and St. Johns River Basin

Item	Base 1965	Projected 1980	Projected 2000	Projected 2020
United States:				
Need for dairy products, total milk equivalent, fat solids basis				
Per capita utilization, lbs.	645	593	593	593
Total need, Mil. lb.	125,061	145,289	200,291	277,184
Florida:				
Share of U.S. milk production, percent	1.1	1.4	1.4	1.4
Production need, mil. lbs.	1,388	2,000	2,900	3,900
St. Johns Basin:				
Share of Florida production, percent	25	23	23	23
Production need, mil. lbs.1/	210	460	667	918
Average annual production per cow, lbs.	7,800	10,000	13,500	17,000
Acreage of improved pasture for dairying, acres	NA	32,200	19,760	10,800

1/ Fat solid basis

TABLE A-10. - Data Relative to Poultry Meat Production, 1965 and Projected to 1980, 2000, and 2020, United States, Florida, and St. Johns River Basin

Item	Base 1965	Projected 1980	Projected 2000	Projected 2020
United States:				
Poultry meat needs				
Per capita, lbs.	57	64	64	64
Total, mil. lbs.	11,124	15,726	21,680	30,071
Florida:				
Share of U. S. Poultry meat production, percent	0.7	1.0	1.0	1.0
Production, mil. lbs.	81.8	157	217	301
Broilers, mil. lbs.	43.7	94	137	196
Other chickens, mil.lbs.	35.9	58	74	96
Turkeys, mil.lbs.	2.2	5	6	9
St. Johns Basin:				
Share of Florida production, percent	27	23	23	23
Production need, mil.lbs.	19.0 1/	35.6	49.6	69.1
Broilers, mil.lbs.	11.7	23.5	34.2	49.0
Other chickens, mil.lbs.	7.2	11.6	14.8	19.2
Turkeys, mil.lbs.	0.1	0.5	0.6	0.9

1/ 1964 production

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TABLE A-11. - Commodity Prices Utilized for Planning Purposes, St. Johns River Basin

Commodity	Unit	Price1/ (Dollars)
Fruits:		
Oranges	Box	1.26
Grapefruit	Box	1.52
Vegetables:		
Beans, lima	Cwt.	12.42
Beans, snap	Cwt.	10.03
Cabbage	Cwt.	2.91
Celery	Cwt.	3.92
Corn	Cwt.	4.70
Cucumbers	Cwt.	6.99
Lettuce	Cwt.	5.76
Peppers, green	Cwt.	11.11
Tomatoes, fresh	Cwt.	8.16
Watermelons	Cwt.	1.72
Irish potatoes	Cwt.	2.87
Corn	Bushel	1.17
Hay, all	Ton	33.66
Peanuts	Pound	.09
Livestock and livestock products:		
Cattle	Cwt.	19.06
Calves	Cwt.	21.12
Hogs	Cwt.	15.05
Milk, wholesale	Cwt.	6.72
Broilers	Pound	0.14
Turkeys	Pound	0.25
Eggs	Dozen	0.36

1/ Source: Interim Price Standards for Planning and Evaluating Water and Land Resources, Interdepartmental Staff Committee of the Water Resources Council, Washington, D.C., April 1966.

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TABLE A-12. - Farm Cash Receipts, 1965 and Projected to 1980, 2000 and 2020, St. Johns River Basin

Item	Income 1965[1/]	Projected Income[2/] 1980	2000	2020
	-----------	Million dollars	-----------	
Crops:				
Citrus	136	129[3/]	180	249
Vegetables, melons and strawberries	27	31[4/]	44	57
Potatoes	16	21[5/]	29	37
Sugarcane for sugar	3.5	- [6/]	--	--
Tobacco	0.2	0.2	0.2	0.2
Corn for grain	0.1	0.2	0.2	0.2
Peanuts, threshed	0.5	0.4	0.5	0.7
Hay	0.3	0.6	1.0	1.2
Minor fruits and nuts	1.5	2.6	3.8	5.2
Other field crops	0.2	0.2	0.3	0.5
All crops	185.3	185.2	259	351
Livestock products:				
Cattle and calves	15	30[7/]	49	78
Dairy products	23	31[8/]	45	62
Eggs	11	18[9/]	30	42
Broilers	1.7	3.3[10]	4.8	6.9
Turkeys	0.1	0.1	0.1	0.2
Other chickens	0.6	1.0	1.4	1.9
Hogs	1.7	1.1	1.2	1.4
Horses and mules	0.3	0.3	0.5	0.6
All livestock	53.4	84.8	132.0	193.0
Greenhouse and nursery products	20	30	45	65
Total	258.7	300	436	609

See next page for footnotes

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TABLE A-12. - (Continued) - Footnotes

1/ Estimated receipts based upon 1965 reports of the Statistical Reporting Service, U. S. Agricultural Statistics, and the 1964 Census of Agriculture for all or portions of 16 counties in the Basin using 1965 commodity prices.

2/ Projected incomes were developed using adjusted normalized prices for Florida from the interim prices set forth by the Water Resources Council, Washington, D. C. April 1966.

3/ Based on a production need of 97 million boxes of citrus in 1980, 136 million boxes in 2000, and 187 million boxes in 2020 valued at a weighted price of $1.33 per field box or $1.26 per box of oranges and $1.52 per box of grapefruit. Two-thirds of income is from the sale of oranges.

4/ Based on a production need of 7.6 million cwt. in 1980, 10.8 million cwt, in 2000, and 13.9 million cwt. in 2020 valued at $4.08 cwt., the normalized price for vegetables grown in the area. Approximately 82 percent of production is fresh market; 18 percent for processing.

5/ Based on 7.3 million cwt. in 1980, 10.1 million cwt. in 2000, and 13 million cwt. in 2020 valued at $2.87 per cwt.

6/ No projected cane production due to closing of Fellsmere operation in Indian River County in 1966. Other production is insignificant.

7/ Based upon an estimated need for 154 million lbs. in 1980, 249 million lbs. in 2000, and 397 million lbs. in 2020 valued at 19.7¢ per lb.

8/ Estimated need of 4.6 million cwt. in 1980, 6.7 million cwt. in 2000, and 9.2 million cwt. in 2020 valued at $6.72 per cwt.

9/ Estimated need of 50 million dozen in 1980, 83 million dozen in 2000, and 117 million dozen in 2020 valued at 36¢ per dozen.

10/ Estimated need of 23.5 million lbs. in 1980, 34.2 million lbs. in 2000 and 49 million lbs. in 2020 valued at 14¢ per lb.

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TABLE A-13. - Florida Farm Cash Receipts, 1965 and Projected to 1980, 2000 and 2020

Item	Income 1965[1]	Projected Income[2]		
		1980	2000	2020
	----------Million dollars----------			
Crops:				
Citrus	316	306[3]	423	582
Vegetables, melons and strawberries	210	247[4]	346	447
Potatoes	25	28[5]	39	50
Sugarcane	48	65[6]	90	125
Tobacco	27	36[7]	49	69
Corn	7.6	10	13	16
Peanuts	9.3	7.1	9.8	14
Minor fruit and nuts	10	9	13	17
Other field crops	10.1	10.6	14.2	20
All crops	663	719	997	1,340
Livestock products:				
Cattle and calves	80	159[8]	258	412
Dairy products	86	134[9]	195	268
Eggs	45	79[10]	126	174
Broilers	6.3	13[11]	19	27
Turkeys	0.5	1.3	1.5	2.2
Other chickens	2.6	4.5	7.3	10
Hogs	14	17	19	21
Other livestock	3.6	6.2	9.2	13.8
All livestock	238	414	635	928
Greenhouse and nursery products	71	100	160	215
Total	972	1,233	1,792	2,483

See next page for footnotes

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TABLE A-13. (Continued) - Footnotes

1/ Receipts based upon The Farm Income Situation, ERS, USDA, Agricultural Statistics, and reports of the Statistical Reporting Service for Florida, 1965.

2/ Projected incomes were estimated using adjusted normalized prices for Florida as agreed upon in the interim prices set forth by the Water Resources Council, Washington, D. C., April 1966.

3/ Based on a production need of 219 million boxes of citrus in 1980, 302 million boxes in 2000, and 418 million boxes in 2020 valued at $1.37 per field box, or $1.26 per box of oranges, $1.52 per box of grapefruit and $3.30 per box of tangerines. Orange production in 1980, 2000, and 2020 is projected to be 159 million boxes, 219 million boxes and 304 million boxes, respectively.

4/ Based on a production need of 55.1 million cwt. in 1980, 77.4 million cwt in 2000, 99.8 mil.cwt. in 2020 valued at $4.26 per cwt., the normalized price using interim prices for Florida referred to in footnote 2.

5/ Production of 9.7 million cwt. in 1980, 13.5 million cwt. in 2000, and 17.3 million cwt. in 2020 valued at $2.87 per cwt.

6/ Production of 7.6 million tons in 1980, 10.6 million tons in 2000, and 14.6 million tons in 2020 valued at $8.50 per ton.

7/ Production of 43 million lbs. in 1980, 59 million lbs. in 2000, and 82 million lbs. in 2020 valued at 84¢ per pound.

8/ Live wt. production of 808 million lbs. in 1980, 1,310 million lbs. in 2000, and 2,090 million lbs. in 2020, valued at 19.7¢ per lb.

9/ Production of 20 million cwt. in 1980, 29 million cwt. in 2000, and 40 million cwt. in 2020 valued at $6.72 per cwt.

10/ Production of 221 million dozen in 1980, 350 million dozen in 2000, and 483 million dozen in 2020 valued at 36¢ per dozen.

11/ Production of 94 million lbs. (live wt.) in 1980, 137 million lbs. in 2000, and 196 million lbs. in 2020, valued at 14¢ per lb.

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TABLE A-14. - Agribusiness Values, Florida, 1965 and Projected to 1980, 2000 and 2020[1/]

Item	Value in 1965	Projected values 1980	2000	2020
	---------Million dollars------------			
Crops:				
Citrus	597	578	799	1,100
Vegetables, melons and strawberries	420	494	692	894
Potatoes	43	48	66	85
Sugarcane	80	110	153	212
Tobacco	32	43	59	83
Corn, grain	12.9	17	22	27
Peanuts, threshed	15.8	12.1	16.7	24
Minor fruits and nuts	20	18	26	34
Other field crops	17.2	18.0	24.1	34
All crops	1,238	1,338	1,858	2,493
Livestock products:				
Beef and veal	120	238	387	618
Dairy products	150	233	339	466
Eggs	76	134	214	296
Broilers	10.7	22	32	46
Turkeys	0.8	2.2	2.6	3.7
Other chickens	4.4	7.6	12.4	17
Hogs	21	26	28	32
Horses and mules	3.6	6.2	9.2	13.8
All livestock	387	669	1,024	1,492
Greenhouse and nursery products	106	150	240	322
Total[2/]	1,731	2,157	3,122	4,307

1/ Based on "Florida Agribusiness, the State's Biggest Business", Florida Department of Agriculture, Tallahassee, January 1966, Agribusiness value, as used here, refers to the direct value added to commodities, due to initial packing, processing, shipping, etc., as they leave the State or exist immediately before final processing at the retail level in the State.

2/ Totals rounded to nearest million dollars.

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TABLE A-15. - Agribusiness Values, St. Johns River Basin, 1965, and Projected to 1980, 2000 and 2020[1]

Item	Value in 1965	Projected values 1980	2000	2020
	-------------	Million dollars	----------	
Crops:				
Citrus	257	244	340	471
Vegetables, melons and strawberries	54	62	88	114
Potatoes	27	36	49	63
Sugarcane	6.0	--	--	--
Tobacco	0.2	0.2	0.2	0.2
Corn, grain	0.2	0.3	0.3	0.3
Peanuts, threshed	0.8	0.7	0.8	1.2
Hay	0.3	0.6	1.0	1.2
Minor fruits and nuts	3.0	5.2	7.6	10.4
Other field crops	0.3	0.3	0.3	0.8
All crops	349	349	487	662
Livestock products:				
Beef and veal	22	45	74	117
Dairy products	40	54	78	108
Eggs	19	31	51	71
Broilers	2.9	5.6	8.2	11.7
Turkeys	0.2	0.2	0.2	0.3
Other chickens	1.0	1.7	2.4	3.2
Hogs	2.6	1.6	1.8	2.1
Horses and mules	0.3	0.3	0.5	0.6
All livestock	88	139	216	314
Greenhouse and nursery products	30	45	68	98
Total[2]	467	533	771	1,074

1/ Based on "Florida Agribusiness, the State's Biggest Business", Florida Department of Agriculture, Tallahassee, January 1966. Agribusiness value, as used here, refers to the direct value added to commodities, due to initial packing, processing, shipping, etc. as they leave the State or exist immediately before final processing at the retail level in the State.

2/ Totals rounded to nearest million dollars.

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SECTION B

FORESTRY

Basic Assumptions

The demand for wood products will increase in the Basin during the time periods covered by this report in accordance with national trends. Per capita consumption of wood products will decrease but population increases will result in an increased total consumption.

Total national consumption of wood products was 12.8 billion cubic feet in 1965 and is anticipated to be 16.2 billion cubic feet by 1980, and 25.6 billion cubic feet by 2020. The consumption of wood products in the Basin will increase from 97.3 million cubic feet in 1965 to 157.4 million cubic feet by 1980, and increase to 360.2 million cubic feet by 2020.

National production of wood products is expected to expand from 11.3 billion cubic feet in 1965 to 14.0 billion cubic feet by 1980, and 21.4 billion cubic feet by 2020. The Basin production of wood products will increase from 56.7 million cubic feet in 1965 to 71.2 million cubic feet by 1980 and reach 165.4 million cubic feet by 2020.

TABLE B-1. - Consumption of Industrial Timber Products, 1965, With Projections to 1980, 2000 and 2020 - United States

	1965 1/	1980 2/	2000 2/	2020 3/
Industrial Timber Products:				
Lumber - Million Bd.ft.	40,900 4/	43,400	53,500	59,900
Veneer - Million Bd.ft.		12,500	18,300	21,500
Misc. Ind. wood - Million cu.ft.		500	500	500
Pulpwood - Million cords	61.8	88.5	141.5	158.7
Converted to Million cubic feet:				
Lumber	8,180	7,074.3	8,720.6	9,763.8
Veneer		2,037.5	2,982.9	3,504.5
Misc. Ind. Wood		500.0	500.0	500.0
Pulpwood	4,633	6,637.5	10,612.5	11,902.5
Total - million cu.ft.	12,813	16,249.3	22,816.0	25,670.8
Per capita consumption - cu.ft.	65.9	65.0	67.5	54.7
Population - million	194.0	250.0	338.2	469.1

1/ Table 15 and 24, Misc. Publication #1066.

2/ Table 43, page 61, Timber Trends in the United States

3/ Extrapolated from Table 43, Timber Trends in the United States

4/ Includes veneer and misc. wood products

TABLE B-2. - Production of Industrial Timber Products, 1965, With Projections to 1980, 2000, and 2020 - United States

		Projections		
	1965	1980	2000	2020
Industrial timber products:				
Lumber - Million cu.ft.	7,320 1/	6,110	7,170	7,870
Veneer - Million cu.ft.		1,540	2,160	2,400
Misc. Industrial Wood Products - Million cu.ft.		460	460	460
Total Lumber, Veneer and Misc. Ind. wood products Million cu.ft.	7,320	8,110	9,790	10,730
Pulpwood - Million cords	52.6	78.4	128.6	142.2
Pulpwood - Million cu.ft. 2/	3,945	5,880	9,645	10,665
Total production - Million cu.ft.	11,265	13,990	19,435	21,395

The 1965 production was taken from Tables 15 and 25, USDA Miscellaneous Publication #1066.

The production for the future time frames was taken from Table 2, Preliminary Projections by ERS and FS, dated August 1967.

1/ Includes veneer and miscellaneous industrial wood products (36,600 million board feet converted to million cubic feet).

2/ One cord equals 75 cubic feet.

Procedures

Prior to making the land use inventory, the forest industry ownership and forestland in large private ownerships were mapped according to the property records in the County Tax Assessors' offices for ten counties having pulp and paper company ownership. These maps showing forestland ownership were used as a guide when making the land use inventory and when projecting land use. It was assumed that the acreage in industrial forestland, and in the National Forest and other public ownership would remain nearly constant for each time frame.

County information furnished by the USDA Forest Service, Southeastern Forest Experiment Station summarized in "Forest Survey Release No. 57" was used to determine ownership of commercial forest land, forest type, degree of stocking, site quality, stand size classes, area condition classes, and stand treatment needed for full productivity.

The net volume and net annual growth of growing stock for the Basin were determined from tables supplied by the Southeastern Forest Experiment Station.

Timber harvested in the Basin by products and species groups, except pulpwood, was taken from the 1965 Commodity Drain Report prepared by the Florida Forest Service. The pulpwood harvested by counties was taken from "Southern Pulpwood Production, 1965", USDA Forest Service and Southern Pulpwood Conservation Association. For partial counties, the total cut was reduced as advised by the farm foresters of the Florida Forest Service, to include amounts cut in the Basin. The amount of annual cut coming from growing stock was 90.69 percent of the total, the remainder being from dead and cull timber.

Estimates were made of the acreage of planting and timber stand improvement required to supply the growth for each time frame, using the acres of stand treatment needed for full productivity (Table B-12) compared with the expected yields from fully stocked stands.

Estimated income from stumpage of wood products, payrolls for harvesting and primary manufacturing, and total impact of the timber resource and forest-based industries for 1980, 2000 and 2020 were based on present stumpage rates and information from "The Demand and Price Situation for Forest Products, 1963".

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Sources of Information

1. Florida's Timber by Larson & Goforth. Forest Survey Release No.57.

2. County tables furnished by the Southeastern Forest Experiment Station.

3. Southern Pulpwood Production, 1965. USDA Forest Service and Southern Pulpwood Conservation Association.

4. Timber Trends in the United States - USDA Forest Service

5. The Demand and Price Situation for Forest Products, 1963. USDA Forest Service Miscellaneous Publication No. 953.

6. The Economic Importance of Timber in the United States. USDA Forest Service Miscellaneous Publication No. 941.

7. Timber Resources for America's Future. USDA Forest Service. Forest Resource Report No. 14.

8. Soil Survey Interpretation for Woodland Conservation, Georgia, 1961. USDA Soil Conservation Service.

9. Water Use - Forest Industries, George W. Stanley, Forest Farmer, Vol. XVI - No. 2, Nov. 1956.

10. Areas of the United States, 1940, from Sixteenth Census, by C. E. Batschelet and M. J. Proudfoot.

11. Florida ASCS, 1965, Annual Report, USDA.

12. The Demand and Price Situation for Forest Products, 1967. Miscellaneous Publication No. 1066, USDA - FS.

13. Commodity Drain Report and list of Primary Wood-Using industries, Florida Forest Service, July 1966.

14. Woodpulp Mills in the United States and Canada, 1965, USDA - Forest Service.

15. Agricultural Statistics - 1963

16. Journal of Forestry, Vol. 66, No. 4, April 1968.

Definition of Terms[1/]

Forest Types

Forest type is based on the crown density of live, free-growing trees and the free-growing seedlings.

Pine types: Stands of longleaf, slash, loblolly, spruce, pond, sand or shortleaf pine and red cedar making up 50 percent or more of the crown density.

Oak-pine type: Stands with yellow pines or red cedar making up at least 25 percent but less than 50 percent of the crown density. The remaining cover is usually hardwoods, but may include cypress, other softwoods or cabbage palmetto.

Hardwood types: Stands with yellow pines or red cedar making up less than 25 percent of the crown density.

Stocking

Stocking is a measure of the degree to which growing space is effectively utilized by trees.

Well stocked: Areas 70 percent or better, stocked with growing stock.
Medium stocked: Areas 40 to 70 percent stocked with growing stock.
Poorly stocked: Areas less than 40 percent stocked with growing stock.

Site Quality Classes

Site quality classes for pine and oak-pine types are determined from an index based on the height of the dominant and codominant trees at 50 years.

Poor site: Site index of 60 or less for loblolly pine type and site index of 50 or less for all other pine types and all oak-pine types.

Fair site: Site index of 70 for loblolly pine type and site index of 60 for all other pine types and all oak-pine types.

Good site: Site index of 80 or greater for loblolly pine type and site index of 70 or greater for all other pine types and all oak-pine types.

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Site quality classes for hardwood types are based on the average length of the saw-log portion at maturity.

Poor site: Evidenced by stands of poor growth and scrubby form, producing short-boled timber with an average length of one 16-foot log or less, usually found on dry sites or poorly drained flats with underlying hardpan.

Fair site: Evidenced by stands of average height and form where the trees may be expected to produce an average merchantable length of two 16-foot logs.

Good site: Evidenced by hardwood stands of the best form and species and capable of producing trees with a merchantable length of three 16-foot logs or more. Such sites are usually found in bottoms of deep, well drained soils, although cypress and tupelo may be found growing on good sites in swampy, wet areas.

Stand Size

Heavy sawtimber stands: Stands containing a net volume of 5,000 board feet or more (International $\frac{1}{4}$ inch rule) per acre.

Light sawtimber stands: Stands containing a net volume of 1,500 but less than 5,000 board feet per acre.

Poletimber stands: Stands failing to qualify as sawtimber but at least 10 percent stocked with poletimber and sawtimber and with at least 5 percent of the stocking in poletimber.

Seedlings and sapling stands: Stands not qualifying as sawtimber or poletimber but having at least 10 percent stocking of growing stock, and with at least 5 percent of the stocking in seedlings and saplings.

Nonstocked and other areas: Commercial forest areas not qualifying as sawtimber, poletimber or seedling and sapling stands. Includes denuded areas and areas stocked with culls.

Area Condition Classes

Class 1: Areas 70 percent or more stocked with desirable trees.

Class 2: Areas 40 to 70 percent stocked with desirable trees and with less than 20 percent of the area controlled by inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

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Class 3: Areas 40 to 70 percent stocked with desirable trees but with 20 percent or more of the area controlled by less desirable cover such as poor growing stock, limited use, rough and rotten trees or shrubs. Also includes all other areas 40 percent or more stocked with growing stock.

Class 4: Areas less than 40 percent stocked with growing stock and with adequate seed source and seedbed favorable to natural restocking, includes upland and flatwood areas with at least five pine seed trees per acre and less than 20 percent of the area controlled by inhibiting vegetation.

Class 5: Areas less than 40 percent stocked with growing stock and with inadequate seed source and/or seedbed unfavorable to natural regeneration. Includes upland areas with less than five pine seed trees per acre and 20 percent or more of the area controlled by inhibiting vegetation, and all lowlands less than 40 percent stocked with growing stock.

TABLE B-3. - Primary Wood-Using Plants by Counties - 1965

County	Pulpmill	Sawmill	Veneer & Crate Mills	Treating Plants	Miscellaneous Plant	Total
			(Number)			
Alachua	0	3	2	1	2	8
Clay	0	2	0	0	0	2
Duval	2	6	1	2	2	13
Flagler	0	1	0	1	0	2
Lake	0	5	2	0	3	10
Marion	0	9	0	0	5	14
Orange	0	3	0	0	0	3
Putnam	1	5	1	1	1	9
St. Johns	0	1	0	0	0	1
Seminole	0	5	0	0	0	5
Volusia	0	4	2	0	1	7
Total	3	44	8	5	14	74

None in: Levy, Osceola, Brevard, Polk, Indian River, Okeechobee, St. Lucie, Sumter

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TABLE B-4. - Commercial Forest Land - 1965

Ownership:	Percent	
National Forest	10	
State, County & Municipal	4	
Forest Industry	29	
Farm	22	
Miscellaneous Private	35	
	100	
Forest Type:	**Percent**	**Acres(1000)**
Pine	56	1983.7
Oak-Pine	6	203.0
Hardwood	38	1327.8
	100	3514.5
Stocking:		
Well Stocked	33	1171.1
Medium Stocked	20	698.8
Poorly Stocked	47	1644.6
	100	3514.5
Site Quality		
Poor Site	27	948.0
Fair Site	41	1450.0
Good Site	32	1116.5
	100	3514.5

TABLE B-5. - Commercial Forest Land - 1965

Stocking By Forest Types:

Type	Total Acres (1000)	%	Well Stocked Acres (1000)	Well Stocked %	Medium Stocked Acres (1000)	Medium Stocked %	Poorly Stocked Acres (1000)	Poorly Stocked %
Pine	1983.7	56	675.5	19	431.2	12	877.0	25
Oak-Pine	203.0	6	100.1	3	38.4	1	64.5	2
Hardwood	1327.8	38	395.5	11	229.2	7	703.1	20
	3514.5	100	1171.1	33	698.8	20	1644.6	47

Site Quality By Forest Type:

Type	Total Acres (1000)	%	Good Site Acres (1000)	Good Site %	Fair Site Acres (1000)	Fair Site %	Poor Site Acres (1000)	Poor Site %
Pine	1983.7	56	761.7	21	637.8	18	584.2	17
Oak-Pine	203.0	6	83.9	3	106.1	3	13.0	*
Hardwood	1327.8	38	270.9	8	706.1	20	350.8	10
	3514.5	100	1116.5	32	1450.0	41	948.0	27

*Less than 0.5 percent

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TABLE B-6. - Timber Cut, Net Growth, and Inventory of Growing Stock and Sawtimber Under Present Level of Management

			Projections-Present Level of Mgt.		
		1965	1980	2000	2020
		Growing stock - thousand cubic ft.			
Timber Cut:	Softwood	46,799	58,441	109,125	138,447
	Hardwood	9,917	12,778	20,041	26,948
	Total	56,716	71,219	129,166	165,395
Net growth:	Softwood	60,190	65,338	53,239	48,036
	Hardwood	12,978	11,929	9,744	8,479
	Total	73,168	77,267	62,983	56,515
Inventory:	Softwood	1,180,880	1,547,588	1,507,267	1,215,251
	Hardwood	564,866	621,962	554,231	450,359
	Total	1,745,746	2,169,550	2,061,498	1,665,610
		Sawtimber - thousand board ft.			
Timber Cut:	Softwood	180,272	250,857	427,742	601,461
	Hardwood	40,074	40,363	49,380	66,505
	Total	220,346	291,220	477,122	667,966
Net Growth:	Softwood	266,116	297,874	236,195	183,911
	Hardwood	42,464	37,765	29,598	24,880
	Total	308,580	335,639	265,793	208,791
Inventory:	Softwood	3,789,746	4,894,582	4,226,260	3,670,880
	Hardwood	1,695,198	1,694,984	1,321,554	1,158,591
	Total	5,484,944	6,589,566	5,547,814	4,829,471

Timber cut from 1965 Commodity Drain Report; Net growth and inventory from "Forest Survey Release No. 57".

TABLE B-7. - Cut, Growth and Inventory of Growing Stock, 1965 and Projections for 1980, 2000 and 2020

	Under Present Forest Management Growing Stock - Thousand Cubic Feet			
	1965	1980	2000	2020
Cut	56,716	71,219	129,166	165,395
Growth	73,168	77,267	62,983	56,515
Inventory	1,745,746	2,169,550	2,061,498	1,665,610

	With Intensive Forest Management Growing Stock - Thousand Cubic Feet		
	1980	2000	2020
Cut	71,219	129,166	165,395
Growth	91,938	166,962	214,277
Inventory	2,581,491	3,352,650	3,577,240

TABLE B-8. - Cumulative Reduction of Forestland Acreage by Types of Loss - 1980, 2000 and 2020

	Thousand Acres			
	1965	1980	2000	2020
Forestland acreage	3,514.5	3,260.2	3,043.8	2,772.6
Loss to Water		50.9	65.0	82.1
Pine stands		(9.0)	(17.6)	(28.7)
Hardwood & Cypress		(41.9)	(47.4)	(53.4)
Loss to land use changes		203.4	405.7	659.8
Total loss		254.3	470.7	741.9
Loss per year		17	11	14

TABLE B-9. - Projected Cut From Growing Stock for 1980, 2000, and 2020 and Growth Needed to Maintain Present Growth-Cut Ratio 1/

	1980	2000	2020
Projected cut, Million cubic feet	71.2	129.2	165.4
Growth needed, Million cubic feet	91.9	167.0	214.3
Growth per acre needed, cubic feet	28.2	54.8	77.3

1/ In 1965, 77 percent of the net annual growth of growing stock was harvested.

TABLE B-10. - Present and Projected Employment, Stumpage Values, Income and Total Impact of the Forest Resource and Forest-Based Industries

	1965	1980	2000	2020
Employment - Number	6700	6300	7300	5700
		(Million dollars)		
Stumpage value	6.5	7.2	13.0	16.7
Income	9.8	10.8	19.6	25.1
Total Impact	112.4	123.2	223.7	286.6

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TABLE B-11. - Commercial Forestland by Area - Condition Classes - 1965

	Area Condition Classes 1	2	3	4	5	Total
Thousand acres	439.7	157.5	1290.5	10.5	1616.3	3514.5
Percent of Total Area	13	4	37	*	46	100

*Less than 0.5 percent

TABLE B-12. - Stand Treatment Needed for Full Productivity of Commercial Forestland - 1965

Type of Land	No Treatment	Stand Improvement	Regeneration: Without site Preparation	Regeneration: With site Preparation	Totals
			(Thousand Acres)		
Flatwoods & uplands	515.3	875.4	545.3	773.0	2709.0
Lowlands	92.7	417.1	44.9	250.8	805.5
Total	608.0	1292.5	590.2	1023.8	3514.5
		(Percent of Total Area)			
Flatwoods & uplands	15	25	15	22	77
Lowlands	2	12	2	7	23
Total	17	37	17	29	100

TABLE B-13. - Timber Harvested - 1965

	Thousand Board Feet: Softwood	Hardwood	Total
Sawtimber	44,888.1	7,583.6	52,471.7
Veneer	1,604.8	17,353.9	18,958.7
Poles and piling	3,398.5	-	3,398.5
Total	49,891.4	24,937.5	74,828.9

	Cords: Softwood	Hardwood	Total
Fence posts	4,005	-	4,005
Excelsior bolts	2,520	-	2,520
Cleat bolts	1,600	-	1,600
Stake bolts	2,760	-	2,760
Box bolts	9,040	13,134	22,174
Handle stock	-	127	127
Other Miscellaneous	8,093	1,753	9,846
Pulpwood	531,037	54,504	585,541
Fuelwood	11,281	17,123	28,404
Total	570,336	86,641	656,977

92,340 tons stumpwood for wood naval stores

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TABLE B-14. - Ocala National Forest Development Program

	Regular Program 1980	2000	2020	Accelerated Program 1980	2000	2020
Transportation						
Roads - Miles	150	300	500	400	700	600
Cost ($1000)	$2,250	$9,000	$15,000	$8,000	$21,000	$32,000
Roadsides - Miles	100	200	400	200	300	600
Cost ($1000)	$100	$200	$500	$200	$400	$900
Trails - Miles	50	250	300	200	300	300
Cost ($1000)	$5	$250	$400	$200	$500	$400
Bridges - Linear Feet	100	300	300	200	500	400
Cost ($1000)	$30	$90	$100	$60	$200	$130
Recreation - Acres	455	1330	2160	595 1/		
Cost ($1000)	$3,550	$13,000	$26,000	$4,631		
Timber Management						
Acres planted or seeded annually	6,500	5,600	5,700			
Cost ($1000)	$165	$146	$150			
Acquisition of Land						
Purchase - Acres	4,000			17,500	2,500	
Cost ($1000)	$800			$5,000	$750	
Rights-of-Way - number	900					
Cost ($1000)	$30					
Exchange - Acres	2,500					

1/ Special Project - Cross-Florida Barge Canal

TABLE B-15. - Range Work Needed for Accelerated Program - Ocala National Forest

	1980				2000				2020			
	No.	Acres	Miles	Dollars	No.	Acres	Miles	Dollars	No.	Acres	Miles	Dollars
Range Allotment Analysis	27	355,500	-	$21,600		Same as 1980				Same as 1980		
Prescribed Burning	-	35,550	-	21,330		" " "				" " "		
Reseeding	-	622	-	12,440		" " "				" " "		
Fertilizing	-	436		4,360		" " "				" " "		
Chopping or Discing	-	1,233	-	18,495		" " "				" " "		
Fence Construction	-	-	110	88,000		" " "			-	-	130	104,000
Cattle Guards	40	-	-	28,000	50	-	-	$35,000	71	-	-	49,700
Corrals	9	-	-	7,200	15	-	-	12,000	3	-	-	2,400
Dipping Vats	9	-	-	4,500	15	-	-	7,500	3	-	-	1,500
Holding Pens	9	-	-	2,250	15	-	-	3,750	3	-	-	750
Water Wells	6	-	-	3,000	5	-	-	2,500	5	-	-	2,500
Reservoirs	4	-	-	400	8	-	-	800	2	-	-	200
Totals	104	393,341	110	$211,575	135	393,341	110	$227,775	114	393,341	130	$239,275

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TABLE B-16. - Future Development for Wildlife and Fish - Ocala National Forest

	1980				2000				2020			
	No.	Acres	Miles	Dollars	No.	Acres	Miles	Dollars	No.	Acres	Miles	Dollars
Upland Development												
Wildlife Openings	1818	5456	-	$109,120	1850	5550	-	$111,000	1800	5400	-	$81,000
Release of Wild-life Forage Plants	100	7440	-	7,440	100	8000	-	8,000	100	8000	-	8,000
Key Wildlife Areas												
Areas	100	350	-	7,000	100	350	-	7,000	90	300	-	6,000
Fencing	-	350	92	73,600	-	350	92	73,600	-	300	85	68,000
Seeding and Planting	100	350	-	7,000	100	300	-	6,000	100	300	-	6,000
Shallow water Impoundments	5	1	-	500	5	1	-	500	5	1	-	500
Totals	2123	13497	92	$204,660	2155	14551	92	$206,100	2095	14301	85	$169,500
Waterfowl Habitat Development												
Planting waterfowl foods	5	20	-	$800	6	60	-	$2,400	6	60	-	$2,400
Impoundments	1	20000	-	$ 50,000	-	-	-	-	4	2000	-	10,000
Nesting Facilities	40	-	-	400	60	-	-	600	60	-	-	600
Totals	46	20020	-	$ 51,200	66	60		$3,000	70	2060		$13,000
Habitat Surveys: 1/												
Big Game Range Analysis	1	361400	-	$ 25,000		Same as 1980				Same as 1980		
Wildlife Habitat Surveys												
Small Game	1	361400	-	15,000		" " "				" " "		
Non-Game	1	361400	-	10,000		" " "				" " "		
Totals	3	1084200	-	50,000		" " "				" " "		
Improvements and Surveys For Fish												
Streams												
a. Improvement	-	-	10	$1,000		Same as 1980				Same as 1980		
b. Surveys	10	-	63	1,890		" " "				" " "		
Lakes												
a. Improvements		31360	-	$600,000		" " "				" " "		
b. Surveys	50	6200	-	5,000		" " "				" " "		
TOtals	60	37560	73	$607,890		" " "				" " "		

1/ Can be made at the same time but are 3 separate jobs.

SECTION C

DETERMINATION OF IRRIGATION WATER REQUIREMENTS[1/]

In surveys and projections of water utilization and conservation, the consumptive water requirement is one of the more important factors to be considered in determining total agricultural water needs. Consumptive use, often called evapotranspiration, is the amount of water used by the vegetative growth at a given locality in transpiration and building of plant tissue, and the amount evaporated from plant foliage and adjacent soil in a specified time. This part of the appendix is concerned with the procedures used in determinations of the consumptive use, net irrigation requirements, and gross irrigation requirements for certain of the agricultural plants grown in the Basin.

In areas where few or no measurements of consumptive use are available, it is usually necessary to estimate use by crops from climatological data. For this purpose, the Soil Conservation Service uses the Blaney-Criddle method with some modification.

Blaney and Criddle found that the amount of water used by crops during their normal growing season was closely correlated with mean monthly temperature and daylight hours. They developed coefficients that can be used to transpose the data from a certain locality to other areas where only climatological data are available. The net amount of irrigation water needed is found by subtracting the effective precipitation from the consumptive water requirement during the growing or irrigation season.

Of the many factors that affect the amount of water used by crops, the more important are temperature, hours of sunshine, and crop growth stage. The temperature and hours of sunshine indicate the amount of solar radiation received by the plant. For a given temperature and growth stage, the amount of water used by a plant during the summer months increases with the latitude because of the longer periods of sunlight.

Consumptive use determinations were made for significant crops produced and irrigated in the Basin. One set of average values for rainfall, temperature, latitude, and other factors affecting irrigation requirements was used for each crop depending on where the majority of the crop was grown in the Basin. Further breakdown for each crop, by locality within the Basin was found not necessary due to the narrow ranges in values for the above factors and the resulting negligible effect on overall irrigation water requirements.

1/ Irrigation Water Requirements, Technical Release No. 21, April 1967, USDA, Soil Conservation Service, Engineering Division

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For citrus, pasture and sugar cane, the growing season was considered to be the entire year and for the other crops, the growing season was considered to be that part of the year when the crop was most likely to be grown.

The following tables give basic information that was used to develop the consumptive use data for the Basin.

TABLE C-1. - Monthly Percentage of Daytime Hours (P) of the Year For Latitudes 27° to 31° North

Latitude North	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
27°	7.44	7.10	8.38	8.66	9.41	9.34	9.53	9.14	8.32	8.04	7.32	7.32
28°	7.40	7.07	8.37	8.67	9.46	9.39	9.58	9.17	8.32	8.02	7.28	7.27
29°	7.35	7.05	8.37	8.69	9.50	9.44	9.62	9.19	8.33	8.00	7.24	7.22
30°	7.31	7.02	8.37	8.71	9.54	9.49	9.67	9.21	8.33	7.99	7.20	7.16
31°	7.25	6.99	8.36	8.73	9.58	9.55	9.72	9.24	8.34	7.97	7.16	7.11

TABLE C-2. - Seasonal Consumptive Use Crop Coefficients (K) for Irrigated Crops

Crop	Length of normal growing season	Consumptive use coefficient (K)1/
Truck crops, small	2 to 4 months	.60 to .70
Potatoes	3 to 5 months	.65 to .75
Cabbage	70 - 90 days	.65 to .75
Celery	115-125 days	.65
Citrus	All year	.55 to .65
Mixed Grasses	All year	.75 to .85
Sugar Cane	All year	.80 to .90
Watermelons	80 to 100 days	.65
Sweet Corn & Tomatoes	3 to 4 months	.60 to .70

1/ The lower values of (K) for use in Blaney-Criddle formula, U=KF, are for the more humid areas, and the higher values are for the more arid climates.

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TABLE C-3. - Values of the Climatic Coefficient, (k_t)[1/] for Various Mean Air Temperature(t)

t	kt	t	kt	t	kt
°F	-	°F	-	°F	-
56	.66	66	.83	76	1.00
57	.67	67	.85	77	1.02
58	.69	68	.86	78	1.04
59	.71	69	.88	79	1.05
60	.72	70	.90	80	1.07
61	.74	71	.91	81	1.09
62	.76	72	.93	82	1.11
63	.78	73	.95	83	1.12
64	.79	74	.97	84	1.14
65	.81	75	.98	85	1.16

1/ Values of (kt) are based on the formula, kt=.0173t - .314

Table C-4 shows the crop growth stage coefficients for various irrigated crops grown in the Basin. These coefficients vary for each crop and each crop (k_c) varies throughout its growing season. Generally, a crop will have a low k_c value during early growth stages. This value increases to a maximum around the time of fruit or bloom production and then gradually tapers off as the crop approaches maturity. For crops other than citrus, pasture, and sugar cane, the growing season chosen was considered to be the most representative for the crops grown in the Basin. Water requirements would vary somewhat for a given crop, depending on the time of the year it is grown. For some of the crops with short growing seasons, the crop growth stage coefficients were broken into 10 to 15-day intervals to more accurately reflect the stage of plant growth.

TABLE C-4. - Crop Growth Stage Coefficient (k_c)

	C R O P		
Month	Citrus	Mixed Grasses	Sugar Cane
January	.63	.48	.49
February	.66	.57	.61
March	.68	.74	.69
April	.70	.86	.76
May	.71	.90	.81
June	.71	.92	.85
July	.71	.92	.85
August	.70	.91	.92
September	.70	.87	.91
October	.69	.80	.83
November	.66	.67	.73
December	.64	.55	.63

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TABLE C-4. - (Continued) - Crop Growth Stage Coefficients (k_c)

Celery		Watermelons		Sweet corn & tomatoes	
Date	kc	Date	kc	Date	kc
February	0.47	Mar 7-16	0.46	Mar 13-22	0.47
March	0.70	Mar 17-26	0.52	Mar 23-April 1	0.57
April	1.09	Mar 27-Apr 5	0.60	Apr 2-11	0.74
May	1.00	Apr 6-15	0.76	Apr 12-21	0.99
		Apr 16-25	0.96	Apr 22-May 1	1.08
		Apr 26-May 5	1.09	May 2-11	1.06
		May 6-15	1.09	May 12-21	1.00
		May 16-25	1.00	May 22-31	0.91
		May 26-June 4	0.92		

Small Vegetables		Potatoes		Cabbage	
Date	kc	Date	kc	Date	kc
Oct 1-10	0.38	Jan 1-10	0.36	Oct 1-15	0.47
Oct 11-20	0.64	Jan 11-20	0.45	Oct 16-30	0.60
Oct 21-30	0.78	Jan 21-30	0.60	Oct 31-Nov 14	0.76
Oct 31-Nov 9	0.82	Jan 31-Feb 9	0.85	Nov 15-29	0.96
Nov 10-19	0.76	Feb 10-19	1.08	Nov 30-Dec 14	1.09
Nov 20-29	0.55	Feb 20-Mar 1	1.27	Dec 15-31	0.92
		Mar 2-11	1.35		
		Mar 12-21	1.35		
		Mar 22-31	1.34		
		Apr 1-10	1.26		

Table C-5 illustrates the procedure for computing the consumptive use of water by citrus, using average climatic factors and crop growth stage coefficients taken from Tables C-1 through C-4. The columns are numbered consecutively and are explained in that order along with an explanation of the various symbols used:

(1) This column shows the breakdown of the growing season into segments to reflect the varying climatic factors and the different crop growth stage coefficients. The citrus growing season is the entire year which is divided into months. For crops that have very short growing seasons, the intervals chosen were shorter than a month in order to more accurately reflect the varying crop growth stages.

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(2) Column 2 is the mean air temperature for each increment of time into which the growing season is divided. This was computed for citrus by averaging the data from selected Weather Bureau stations with 30 years of records in the citrus producing area of the St. Johns Basin.

(3) This column is the percent of the total yearly daylight hours falling in each time period. This data was taken from Table C-1 using a latitude of 28° North as representative of citrus in the Basin.

(4) The factor (f) column is the product of mean monthly temperature and monthly percentage of daylight hours.

(5) The kt column is the climatic coefficient which is related to the mean air temperature (t). This column is based on the empirical formula $kt=.0173t-.314$ and can be taken directly from Table C-3.

(6) The k_c values given in column 6 reflect the growth stage of the crop. These values are taken from Table C-4 which were developed from research data.

(7) This column (k) is the empirical consumptive use crop coefficient for each interval of time into which the growing season is divided. This (k) value is computed by multiplying (k_t) by (k_c).

(8) The consumptive use (u) is the actual amount of water consumed by the crop in inches during each interval of time. This is found by multiplying the values in the (k) column by the (f) column. The total of the consumptive use column is the amount of water required by a crop during the growing season for optimum growth.

(9) This column is the adjusted consumptive use (u) for the crop. If the total of column 8 is not in agreement with the seasonal consumptive use found by the formula $U=KF$ where the seasonal consumptive use factor (K) is taken from Table C-2 then an adjustment can be made to bring the consumptive use into agreement if necessary.

(10) This is the average rainfall column and is based on Weather Bureau records at stations with 30 years of record in the citrus producing part of the Basin.

(11) Column 11 shows that part of the total rainfall that is effective in meeting the consumptive use requirements and is computed by using Table C-6. The effective rainfall is given for both 1.5 inches and 3.0 inches net depth of application of water. A net depth of 1.5 inches was used for the Basin as this is usually the maximum that the soil can hold in the root zone of most crops.

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(12) Column 12 lists the net irrigation requirement which is found by subtracting the effective rainfall from the adjusted consumptive use.

(13) Column 13 shows two values for gross irrigation requirements with one based on a 75% efficiency of application and the other based on a 65% efficiency of application.

The lower case letters such as f, kt, kc, k, u, rt, and re refer to subdivisions of the total growing season, and the capital letters such as F, Kt, Kc, K, U, Rt and Re, refer to seasonal or total yearly values.

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TABLE C-5. - Citrus

K=.60

(1)	(2)[1/]	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)[1/]	(11)		(12)	(13)	
	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con Use u	Adj Use u	rt	re (3.0)	re 1.5	NIR	GIR 75% eff	GIR 65%eff
	oF	%					In.	In.	In.	In.	In.	In.	In.	In.
Jan	60.3	7.40	4.46	.729	.63	.459	2.05	1.87	1.99	(1.25)	1.08	0.79	1.05	1.21
Feb	61.8	7.07	4.37	.755	.66	.498	2.18	1.99	2.52	(1.60)	1.38	0.61	0.81	0.94
March	65.4	8.39	5.49	.817	.68	.555	3.05	2.78	3.69	(2.33)	2.00	0.78	1.04	1.20
April	70.6	8.68	6.13	.907	.70	.635	3.89	3.55	3.52	(2.36)	2.03	1.52	2.03	2.34
May	76.1	9.46	7.20	1.003	.71	.712	5.13	4.68	3.74	(2.65)	2.28	2.40	3.20	3.69
June	80.3	9.38	7.53	1.075	.71	.763	5.75	5.24	7.26	(4.82)	4.15	1.09	1.45	1.68
July	81.6	9.58	7.82	1.098	.71	.780	6.10	5.56	7.55	(4.98)	4.28	1.28	1.71	1.97
Aug	81.8	9.16	7.49	1.101	.70	.771	5.77	5.26	6.88	(4.59)	3.95	1.31	1.75	2.02
Sept	80.0	8.32	6.65	1.070	.70	.749	4.98	4.54	7.74	(4.54)	3.90	0.64	0.85	0.98
Oct	73.9	8.02	5.92	.964	.69	.665	3.94	3.59	5.15	(3.18)	2.73	0.86	1.15	1.32
Nov	66.1	7.27	4.80	.830	.66	.548	2.63	2.40	1.94	(1.25)	1.08	1.32	1.76	2.03
Dec	61.2	7.27	4.45	.745	.64	.477	2.12	1.93	1.98	(1.20)	1.03	0.90	1.20	1.38
			72.31				47.59	43.39	53.96		29.89	13.50	18.00	20.76

U=KF

U=0.60x72.31 = 43.39 inches

1/ For selected stations in citrus producing area with 30 years record (Average of North Central and South Central)

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TABLE C-6. - Average Monthly Effective Rainfall[1/] As Related to Mean Monthly Rainfall and Average Monthly Consumptive Use

Monthly Mean Rainfall r_t Inches	Average Monthly Consumptive Use, u, in Inches									
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
	Average Monthly Effective Rainfall, r_e, in Inches									
0.5	.30	.32	.35	.36	.37	.40	.42	.45	.47	.50
1.0	.60	.65	.70	.72	.74	.79	.82	.88	.98	1.00
1.5	.90	.98	1.05	1.10	1.13	1.17	1.22	1.32	1.45	1.50
2.0	1.00 1.67	1.29	1.38	1.43	1.47	1.56	1.62	1.75	1.88	2.00
2.5		1.5	1.70	1.78	1.84	1.94	2.02	2.15	2.30	2.50
3.0		1.85	1.99	2.11	2.20	2.30	2.41	2.55	2.70	2.95
3.5		2.00 3.23	2.27	2.41	2.55	2.64	2.79	2.95	3.11	3.38
4.0			2.55	2.71	2.88	2.97	3.15	3.32	3.51	3.80
4.5			2.82	3.00	3.21	3.30	3.49	3.71	3.92	4.22
5.0			3.00 4.87	3.26	3.51	3.62	3.83	4.09	4.32	4.63
5.5				3.55	3.81	3.95	4.17	4.45	4.71	5.04
6.0				3.81	4.09	4.24	4.50	4.80	5.08	5.44
6.5				4.00 6.37	4.35	4.52	4.80	5.12	5.42	5.81
7.0					4.60	4.80	5.10	5.41	5.72	6.15
7.5					4.84	5.06	5.36	5.68	6.03	6.45
8.0	1.00	2.00	3.00	4.00	5.00 7.89	5.31	5.60	5.93	6.32	6.74

1/ Based on 3-inch net depth of application. For other net depths of application, multiply by the factors shown below

Net Depth of Application	.75	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0	7.0
Factor	.72	.77	.86	.93	.97	1.00	1.02	1.04	1.06	1.07

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TABLE C-6. - (Cont.)

Note: Average monthly effective rainfall cannot exceed average monthly rainfall or average monthly consumptive use. When the application of the above factors results in a value of effective rainfall exceeding either, this value must be reduced to a value equal to the lesser of the two. Factors should not be applied to the values of average monthly effective rainfall shown below those encircled. Where mean monthly rainfall (r_t) is less than 0.5 inch it may be assumed to be 100 percent effective.

For the Basin, a net depth of application of 1.5 inches was used so that all values read from Table C-6 were multiplied by the factor of 0.86. This is necessary because the values in Table C-6 were computed for a 3-inch net depth of application. Table C-6 is self-explanatory but is somewhat difficult to use because it requires double interpolation to compute the average effective rainfall.

Technical Release No. 21 (Rev. 1) of the Soil Conservation Service Engineering Division has Table C-6 in graph form which is easier to use for computing effective rainfall. Technical Release No. 21 should be consulted for a more detailed explanation of the use of the Blaney-Criddle method of computing consumptive use for crops.

Tables C-7 through C-14 show the consumptive use of other agricultural crops commonly grown in the Basin. Sugar cane is included even though there is none grown in the Basin at the present time. There has been a considerable acreage of sugar cane grown in prior years.

Effective rainfall supplies a portion of the consumptive use of plants. However, since there are no records of effective rainfall available, it is necessary to utilize total rainfall records and estimate the portion of total rainfall that is effective. The procedure used in making this determination takes into account factors that influence rainfall effectiveness. These factors are total rainfall, consumptive use rate, and net irrigation application. In areas of high total rainfall during the growing season, the effectiveness of rainfall is generally low by comparison. When the consumptive use rate of a plant is high, available moisture in the soil profile is depleted rapidly. This increases the rate at which the soil can receive rainfall. The higher the rate of consumptive use, the greater will be the rainfall effectiveness.

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The net irrigation application is dependent upon the capacity of the soil in the root zone to store readily available moisture for plant use. When this capacity is low and a storm of considerable magnitude occurs, only a small percentage of the precipitation may be needed to fill the soil to field capacity and the resulting rainfall effectiveness will be low. Conversely, if the capacity is high, all or most of the rainfall resulting from a storm might be stored in the soil before the field capacity level is reached. In this case, the effectiveness of rainfall would be relatively high.

Curves and tables have been developed to show the relationship between effective rainfall and the three variable factors discussed previously. Table C-6 shows the relationship between average monthly effective rainfall, (r_e), mean monthly rainfall (r_t), and average monthly consumptive use (u). The values of (r_e) are based on a three-inch net irrigation application.

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TABLE C-7. - Small Vegetables

K=.65

	Avg. Temp. °F	Daylight Hours p %	f	kt	kc	k	Con Use u In.	Adj Use u In.		rt In.	re (3.0)	re 1.5	NIR	GIR
Oct 1-10	76.5	2.59	1.98	1.009	0.38	0.383	0.76	0.85						
Oct 11-20	74.1	2.59	1.92	.968	0.64	0.620	1.19	1.33	3.82	3.96	(2.65)	2.28	1.54	2.05
Oct 21-30	71.7	2.59	1.86	.926	0.78	0.722	1.34	1.50						
Oct 31-Nov 9	68.9	2.44	1.68	.878	0.82	0.720	1.21	1.35						
Nov 10-19	66.2	2.42	1.60	.832	0.76	0.632	1.01	1.13	3.18	1.57	(1.10)	0.95	2.23	2.97
Nov 20-30	64.0	2.67	1.71	.793	0.55	0.436	0.75	0.84						
			10.75				6.26	7.00		5.53		3.23	3.77	5.02

U = KF

U = 0.65 x 10.75 = 7.00 inches

Based on Orlando rainfall and temperature records

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TABLE C-8. - Potatoes

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con Use u	Adj Use u		rt	re (3.0)	re 1.5	NIR	GIR
							In.	In.		In.	In.			
Jan 1-10	58.8	2.36	1.39	.706	.36	.254	.35	.28						
Jan 11-20	59.2	2.36	1.40	.706	.45	.318	.45	.36	1.19	2.17	(1.32)	1.14	0.04	0.05
Jan 21-30	58.7	2.36	1.41	.724	.60	.434	.61	.48						
Jan 31-Feb 9	60.3	2.51	1.51	.724	.85	.615	.93	.74						
Feb 10-19	61.0	2.52	1.54	.741	1.08	.800	1.23	.98	2.80	3.27	(2.10)	1.81	0.99	1.32
Feb 20-Mar 1	61.9	2.68	1.66	.759	1.27	.964	1.60	1.28						
Mar 2-11	63.2	2.70	1.71	.776	1.35	1.048	1.79	1.43	4.76	3.95	(2.79)	2.40	2.36	3.15
Mar 12-21	65.2	2.70	1.76	.810	1.37	1.110	1.95	1.56						
Mar 22-31	67.2	2.70	1.81	.845	1.34	1.132	2.05	1.64	1.78	1.17	(0.74)	0.64	1.14	1.52
Apr 1-10	69.0	2.91	2.01	.880	1.26	1.109	2.23	1.78						
			16.20				13.19	10.53		10.56		5.99	4.53	7.03

U = KF

U = 0.65x16.20 = 10.53 inches

Based on Palatka rainfall and temperature records

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TABLE C-9. - Cabbage

K= .65

	Avg. Temp. °F	Daylight Hours p %	f	kt	kc	k	Con Use u In.	Adj Use u In.		rt In.	re (3.0)	re 1.5 In.	NIR	GIR
Oct 1-15	73.4	4.00	2.94	.949	.47	.446	1.31	1.36						
Oct 16-30	71.1	3.99	2.84	.914	.60	.548	1.54	1.59	3.06	4.92	(3.05)	2.62	0.44	0.59
Oct 31-Nov 14	66.9	3.60	2.41	.845	.76	.642	1.55	1.60						
Nov 15-29	63.5	3.59	2.28	.793	.96	.761	1.74	1.80	3.41	1.77	(1.25)	1.08	2.33	3.11
Nov 30-Dec 14	60.7	3.57	2.17	.741	1.09	.808	1.75	1.81						
									3.11	2.44	(1.58)	1.36	1.75	2.33
Dec 15-31	58.9	3.57	2.10	.706	.92	.650	1.37	1.42						
			14.74				9.36	9.58		9.13		5.06	4.52	6.03

U = KF

U = .65 x 14.74 = 9.58 inches

Based on Palatka rainfall and temperature records

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TABLE C-10. - Celery

K=.65

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con Use u	Adj Use u	rt	re (3.0)	re 1.5	NIR	GIR
	°F	%					In.	In.		In.	In.	In.	In.
February	61.8	7.07	4.37	.759	.47	.357	1.56	1.30	2.41	(1.46)	1.26	0.04	0.05
March	65.5	8.39	5.49	.828	.70	.580	3.18	2.65	3.55	(2.25)	1.94	0.71	0.95
April	70.6	8.68	6.13	.914	1.09	.996	6.11	5.10	3.41	(2.52)	2.17	2.93	3.91
May	76.3	9.46	7.22	1.001	1.00	1.001	7.23	6.03	3.41	(2.58)	2.22	3.81	5.08
			23.21				18.08	15.09	12.78		7.59	7.49	9.99

U = KF

U = 0.65 x 23.21 = 15.09 inches

Based on Orlando & Sanford rainfall and temperature data

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TABLE C-11. - Mixed Grasses

K = .75

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con.Use u	Adj.Use u	rt	re (3.0)	re 1.5	NIR	GIR
	OF	%					In.	In.	In.	In.	In.	In.	In.
Jan	60.3	7.35	4.43	0.724	0.48	0.348	1.542	1.49	2.10	(1.30)	1.12	0.37	0.49
Feb	61.8	7.05	4.36	.759	0.57	.433	1.888	1.82	2.74	(1.70)	1.46	0.36	0.48
March	65.4	8.38	5.48	.810	0.74	.599	3.283	3.17	3.75	(2.45)	2.11	1.06	1.41
April	70.6	8.70	6.14	.914	0.86	.786	4.826	4.65	3.47	(2.47)	2.12	2.53	3.37
May	76.1	9.50	7.23	1.001	0.90	.901	6.514	6.28	3.55	(2.70)	2.32	3.96	5.28
June	80.3	9.44	7.58	1.070	0.92	.984	7.459	7.19	6.88	(5.10)	4.39	2.80	3.73
July	81.6	9.63	7.86	1.105	0.92	1.017	7.994	7.71	7.51	(5.60)	4.82	2.89	3.85
Aug	81.8	9.19	7.52	1.105	0.91	1.006	5.565	7.29	6.97	(5.16)	4.44	2.85	3.80
Sept	80.0	8.33	6.66	1.070	0.87	.931	6.200	5.98	7.38	(4.97)	4.27	1.71	2.28
Oct	73.9	8.00	5.91	.966	0.80	.773	4.568	4.40	5.05	(3.40)	2.92	1.48	1.97
Nov	66.1	7.23	4.78	.828	0.67	.555	2.653	2.56	1.91	(1.28)	1.10	1.46	1.95
Dec	61.2	7.21	4.41	.741	0.55	.408	1.799	1.73	2.14	(1.34)	1.15	0.58	0.77
			72.36				56.291	54.27	53.45		32.22	22.05	29.38

U = KF

U = 0.75 x 72.36 = 54.27 inches

Based on 14 stations throughout St. Johns Basin with at least 30 years of rainfall and temperature records.

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TABLE C-12. - Sugar Cane

K = .80

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con.Use u	Adj.Use u	rt	re (3.0)	re 1.5	NIR	GIR
	°F	%					In.	In.	In.	In.	In.	In.	In.
Jan	63.2	7.40	4.67	.779	.493	.384	1.79	1.85	2.12	(1.32)	1.14	0.71	0.95
Feb	64.5	7.07	4.56	.802	.610	.489	2.23	2.31	2.44	(1.59)	1.37	0.94	1.25
March	67.4	8.39	5.65	.852	.694	.591	3.34	3.46	3.63	(2.41)	2.07	1.39	1.85
April	71.9	8.68	6.24	.930	.756	.703	4.39	4.54	3.55	(2.52)	2.17	2.37	3.16
May	76.3	9.46	7.22	1.006	.806	.811	5.86	6.07	4.18	(3.10)	2.67	3.40	4.53
June	80.3	9.38	7.53	1.075	.850	.914	6.88	7.12	7.53	(5.41)	4.65	2.47	3.29
July	81.8	9.58	7.84	1.101	.890	.980	7.68	7.95	7.29	(5.53)	4.76	3.19	4.25
Aug	82.0	9.16	7.51	1.105	.918	1.014	7.62	7.89	7.53	(5.65)	4.86	3.03	4.04
Sept	80.5	8.32	6.70	1.079	.910	.982	6.58	6.81	9.74	(6.70)	5.76	1.05	1.40
Oct	75.6	8.02	6.06	.994	.833	.828	5.02	5.20	7.52	(4.90)	4.21	0.99	1.32
Nov	68.8	7.27	5.00	.876	.730	.639	3.20	3.31	2.25	(1.57)	1.35	1.96	2.61
Dec	64.4	7.27	4.68	.800	.626	.501	2.34	2.42	1.87	(1.25)	1.08	1.34	1.79
			73.66				56.93	58.93	59.65		36.09	22.84	30.44

Seasonal K = $\frac{56.93}{73.66}$ = 77.29

U = KF

U = 0.80 x 73.66 = 58.93 inches

Based on Fellsmere rainfall and temperature records.

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TABLE C-13. - Watermelons

K = .65

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con.Use u	Adj.Use u		rt	re (3.0)	re 1.5	NIR	GIR
	°F	%					In.	In.		In.	In.	In.	In.	In.
Mar 7-16	62.8	2.7	1.69	.776	.46	.357	.60	.49						
Mar 17-26	64.5	2.7	1.74	.810	.52	.421	.73	.60	1.46	3.31	(1.46)	1.26	0.20	0.31
Mar 27-Apr 5	66.3	2.8	1.86	.828	.60	.497	.92	.75						
Apr 6-15	68.4	2.9	1.98	.862	.76	.655	1.30	1.06	3.85	3.72	(2.51)	2.16	1.69	2.60
Apr 16-25	70.5	2.9	2.04	.905	.96	.869	1.77	1.50						
Apr 26-May 5	72.7	3.0	2.18	.944	1.09	1.029	2.24	1.83						
May 6-15	74.8	3.1	2.32	.978	1.09	1.066	2.47	2.02	6.10	3.48	(2.64)	2.27	3.83	5.89
May 16-25	76.7	3.1	2.38	1.015	1.00	1.015	2.42	1.98						
May 26-Jun 4	78.3	3.2	2.51	1.040	.92	.957	2.40	1.96	.78	0.88	(0.50)	0.43	0.35	0.54
			18.70				14.85	12.19		11.39		6.12	6.07	9.34

U = KF

U = 0.65 x 18.70 = 12.16 inches

Based on Gainesville rainfall & temperature records

TABLE C-14. - Sweet Corn & Tomatoes

	Avg. Temp.	Daylight Hours p	f	kt	kc	k	Con.Use u	Adj.Use u		rt	re (3.0)	re 1.5	NIR	GIR
	°F	%					In.	In.		In.	In.	In.	In.	In.
Mar 13-22	65.1	2.71	1.76	.812	0.47	0.382	0.67	0.53	1.15	2.09	(1.15)	0.99	0.16	0.21
Mar 23-Apr 1	66.7	2.73	1.82	.840	0.57	0.479	0.87	0.69						
Apr 2-11	68.5	2.89	1.98	.871	0.74	0.645	1.28	1.01	4.05	3.42	(2.37)	2.04	2.01	2.68
Apr 12-21	70.5	2.89	2.04	.906	0.99	0.897	1.83	1.45						
Apr 22-May 1	72.4	2.91	2.11	.939	1.08	1.014	2.14	1.69						
May 2-11	74.4	3.05	2.27	.973	1.06	1.031	2.34	1.85	5.65	3.57	(2.65)	2.28	3.37	4.49
May 12-21	76.3	3.05	2.33	1.007	1.00	1.007	2.35	1.86						
May 22-31	77.9	3.05	2.38	1.033	0.91	.940	2.24	1.77						
			16.69				13.72	10.85		9.08		5.31	5.54	7.38

$U = KF$

$U = 0.65 \times 16.69 = 10.85$ inches

Rainfall & temperature based on Orlando rainfall and temperature records.

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Water is one of many important factors in crop or vegetative plant growth. Consumptive use of water by the plants as previously discussed included effective rainfall as one determinant in the analysis of irrigation water needs. Soil properties or characteristics play an important part in the degree of rainfall effectiveness. The "Conservation Irrigation Guide for Design of Sprinkler Irrigation Systems for Florida, 1963" was used in interpreting the irrigation characteristics of the soils listed in Table E-1, Section E of the Technical Appendix. From interpretations made for the irrigable soils in the Basin, it was determined that generally the water to be replaced at each irrigation cycle would be as shown in Table C-15.

TABLE C-15. - Water to Be Replaced Each Irrigation For Named Soils

		Inches 1/		
0.7 - 1.3	0.7 - 1.5	0.7 - 1.9	0.8 - 2.0	0.7 - 2.4
Blichton	Adamsville	Archer	Delray	Basinger
Parkwood	Arredondo	Bradenton	Ona	Gainesville
	Astatula	Hernando	Orlando	Osier
	Blanton	Stilson	Placid	Felda
	Charlotte		Scranton	Sunniland
	Chiefland			Hague
	Cocoa			Portsmouth
	Kanapaha			Rains
	Lake			Zuber
	Leon			Manatee
	Myakka			Chipley
	Pompano			
	St. Johns			
	Bayboro			
	Bladen			
	Coxville			
	Fellowship			
	Meggett			

1/ The amount varies according to the root zone depth of the plant to be irrigated.

SECTION D

CHANNEL DESIGN CRITERIA
DETERMINATION OF LAND AND WATER AREA AND USE

Channel Design

Channels were designed in accordance with National and State criteria of the Soil Conservation Service as contained in the following publications:

1. Technical Release No. 25 "Planning and Design of Open Channels".

2. Engineering Memorandum FL-15 "Criteria for Use in Planning and Designing Channels and Structures".

Hydrologic determinations were made for rates of runoff that would provide protection for the major agricultural crops produced in the identifiable subdrainage areas of the planning units (hydrologic units). To simplify the procedures used in determining the quantity of runoff from the units having mixed land uses, the various uses were converted to an equivalent area (square miles) of the highest value major agricultural use. The factors used in converting to equivalent drainage areas are shown in the following tabulation.

To convert one square mile of	Multiply by Factor for Square Mile of Equivalent				
	Woods 1/	Pasture	Citrus	Vegetables	Urban & Built-Up
			(Factor)		
Woods to 1/	-	0.435	0.210	0.143	0.143
Pasture to	2.295	-	0.484	0.333	0.333
Citrus to	4.750	2.070	-	0.688	0.688
Vegetables to	6.900	3.005	1.454	-	-
Urban & Built-Up to	6.900	3.005	1.454	-	-

1/ Range & miscellaneous same as for woods.

The equivalent area would then have the same removal rate it would have if it were all in the one use. These equivalent areas were applied in the modified Cypress Creek Formula, Q=CM 5/6, to determine the removal rates for the specific uses. In this formula, Q is the average runoff rate in cubic feet per second for the 24-hour period of greatest runoff for a storm event; M is the equivalent drainage area in square miles; and C is a coefficient based primarily on the level of protection desired. The "C" values used in these calculations are: Forestland, 15, Pasture, 30; Citrus, 55; and Vegetables, 75.

In general, the maximum allowable design velocity was limited to two feet per second to prevent excessive erosion. Before channels are constructed, more thorough geologic investigations would be needed to determine maximum allowable channel velocities. Where channel velocities can be increased without excessive erosion, fewer grade control structures would be required, and therefore less expense would be involved.

A coefficient of friction (n) of 0.035 was used in computing channel sizes in order to simplify design procedures. This value is for an average condition. In actual construction, a range of values would be used depending on size of channel, material through which the channel is to be constructed and the maximum allowable velocity of a newly constructed channel.

In most instances, channel design was started at the lower end of the watershed and proceeded upstream with a slope equal to the average ground slope unless this resulted in excessive velocity, in which case a slope was used which gave a velocity of two feet per second. When the design water surface reached an elevation of five feet below ground surface, a grade control structure was proposed that would raise the design water surface to approximately ground elevation.

A side slope of one to one was used for all excavated channels.

Manning's formula was used to compute channel sizes and slopes with the water surface parallel to the bottom grade. This eliminated the problem of having to compute water surface profiles where water was not at normal depth.

Where channels exist in areas projected to be improved by channelization, the capacities of existing channels were not considered unless they are adequate to meet projected needs without further improvement. It has been estimated that the cost for enlarging a small channel is not substantially lower than for construction of a new channel.

Land and Water Area

The location of the Basin boundary and determination of total area were the results of joint efforts between the U.S. Geological Survey and the Soil Conservation Service.

Total county area figures of the Bureau of the Census were accepted for counties entirely within the Basin. Water areas were measured, by counties, on aerial photographs and these acreages were subtracted from the Census data to obtain county land areas. Areas of counties only partially within the Basin were measured on county highway maps.

The entire Basin was delineated into planning units. These delineations were transferred to county maps on which soil association areas had been outlined. Areas were measured and coded for each soil association area within the planning units. Estimates were made of the soils (in percent) comprising each coded area.

Land Use

Land use estimates were also made for each of the individual coded areas. Non-agricultural and water areas, as measured on county maps and aerial photographs were tabulated and subtracted from total areas to determine the extent of agricultural lands. The non-agricultural category includes land used for residential (10 acres or more in one location), commercial, and industrial purposes, as well as for highway and railroad rights-of-way, golf courses, airports, mines, and other lands which are reserved for such uses as recreation and wildlife.

Projected acreages for agricultural purposes were estimated on the basis of projected population requirements and in terms of the Basin's ability to maintain it's proportionate share of State and National production of agricultural products. This land use data was compared to the uses of the land resources in 1965 by capability classes and subclasses. The projected increases in area of fresh water and in the use of land for non-agricultural purposes were subtracted from the 1965 agricultural land base. It was assumed that the decrease in the agricultural base would affect all uses and all capability classes and subclasses.

The projected allocation of various agricultural uses to each county and planning unit took into account present use patterns and the availability of soils of suitable capabilities.

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SECTION E

SOILS

The nature of the soils that exist within an area has a major influence on any use to which they may be put. Some soils have physical properties that make them well suited to a wide variety of uses without any special treatment. Others require considerable alteration before any practical use can be made of them. A knowledge of the physical nature of the soils is essential to any study that deals with land use and projected land use development. Much of the data that has been evolved for inclusion in the Basin Report is based on an appraisal of the different kinds of soils that exist, by planning units, within the Basin.

Determination of Location and Extent of Significant Soils

Since soil interpretations are based on individual kinds of soils, some reasonable means was needed to gain reliable information about the kinds, extent and location of the many different soils. This was done by making use of existing general soil maps, detailed soil surveys and aerial photographs.

General soil maps are available for all counties, (Figures E-1 through E-19). These maps show soil associations that are made up of soils sometimes strongly contrasting, which normally occur together in typical patterns. The Legend for the General Soil Maps, pages 13 through 17 lists the soil associations recognized in the Basin and gives a brief description of each. The soil associations are described in terms of the dominant kinds of soils in them.

Detailed soil surveys are available for all of Seminole, Orange and Okeechobee counties. Similar surveys are in progress and nearing completion in Lake County and are well underway in Brevard and Marion counties. Surveys of sample areas and large and small farm tracts are scattered throughout the rest of the Basin. Aerial photographs that show much detail in land form and vegetation are available for the entire Basin.

By using the detailed surveys, the general soil maps, and the aerial photographs, reasonably accurate estimates of the kinds, location and extent of the soils can be made. Three methods were used: (1) Where detailed soil surveys cover an entire area, direct estimates were made. (2) Where areas were partially surveyed, the available surveys were analyzed and percentages expanded to entire soil associations. (3) Where no part of a soil association area was surveyed, it was studied on aerial photographs and in the field if doubt existed, and related to nearby areas of the same soil association. This procedure assures reasonable reliability for broad scale interpretations, but obviously is not reliable for specific site interpretation.

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Interpretation of Soils Information for Agricultural Uses

Interpretations that deal with agricultural use of the land are based on land capability ratings of the various kinds of soils. The capability ratings used are standard according to correlations recognized in the southern states by the Soil Conservation Service since March 1965. They are based on criteria defined in "Land Capability Classification - Agriculture Handbook No. 210, USDA-SCS, September 1961". The following definitions of capability classes and subclasses are from that publication.

Class I - Soils in Class I have few limitations that restrict their use.

Class II - Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III - Soils in Class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV - Soils in Class IV have very severe limitations that restrict the choice of plants and require very careful management.

Class V - Soils in Class V have little or no erosion hazard but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VI - Soils in Class VI have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII - Soils in Class VII have very severe limitations that make them unsuited for cultivation and that restrict their use largely to grazing, woodland or wildlife.

Class VIII - Soils and land forms in Class VIII will have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply or aesthetic purposes.

Subclasses are groups of capability units within classes that have the same kinds of dominant limitations for agricultural use.

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Some soils are subject to erosion if they are not protected, while others are naturally wet and must have water management in the form of flood protection and drainage if crops are to be grown. Some soils are shallow or droughty, or have other soil deficiencies. The three kinds of limitations recognized at the subclass level are: Risks of erosion, designated by the symbol (e); wetness, poor drainage, or overflow (w); and root-zone limitations (s).

Table E-1 shows the significant soils of the Basin and their rating according to capability classes and subclasses:

TABLE E-1. - Principal Soils of the St. Johns River Basin and Their Rating According to Capability Classes and Subclasses

Soil Name	Capability Class and Subclass	Soil Name	Capability Class and Subclass
Adamsville	IVw	Kanapaha	IIIw
Archer	IIIs	Keri	IVw
Arredondo (AB slope)	IIIs	Lake (AB slopes)	IIIs
Arzell	VIIw	(C slopes)	IVs
Astatula AB	VIIs	Lakeland (AB slopes)	IIIs
C	IVs	(C slopes)	IVs
Basinger	IVw	Leon	IVw
Bayboro	IIIw	Manatee	IIIw
Bladen	IIIw	Mascotte	IIIw
Blichton	IIIw	Meggett	IIIw
Bradenton	IIIw	Myakka	IVw
Brighton	IIIw	Ona	IIw
Broward	IVw	Orlando	IIIs
Charlotte	IVw	Osier	IVw
Chiefland	IVs	Palm Beach	IIIs
Chipley	IIIs	Paola	VIs
Coastal Beach	VIIIs	Pamlico	IIIw
Coastal Dunes	VIIIs	Parkwood	IIIw
Cocoa	IVs	Placid	Vw(VIIw)1/
Copeland	IIIw	Plummer	IVw
Coxville	IIIw	Pomello	Vw
Delray	IIIw	Pompano	IVw
Everglades	IIIw	Portsmouth	IIIw
Felda	IIIw	Rains	Vw
Fellowship (AB slopes)	IIIw	Rutlege	Vw(VIIw)1/
(C slopes)	IVs	St. Johns	IVw
Gainesville (AB slopes)	IIIs	St. Lucie	VIIs
(C slopes)	IVe	Salt Marsh	VIIIw
Hague	IIe	Scranton	IIw
Hernando	IIIs	Stilson	IIw
Iberia	Vw	Sunniland	IIIw
Immokalee	IVw	Swamp	VIIw
Istokpoga	IVw	Terra Ceia	IIIw
Jonesville (AB slopes)	IIIs	Vaucluse	IIIs
(C slopes)	IVs	Zuber	IIe

1/ Some areas of Placid and Rutlege that are deep in swamps are included with swamps as Class VIIw.

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Interpretation of Soils Information for Non-Agricultural Uses

Interpretations for non-agricultural uses are based on the same physical soil properties significant to agricultural interpretations. Whereas, the physical properties of the soil when used for agriculture are interpreted in terms of capability classes and sub-classes, these same physical properties are interpreted for non-agricultural uses in terms of limitations, restrictions or hazards they impose on the proposed use. In this kind of interpretation, soils are rated according to physical properties they possess that affect their ability to support the weight of buildings, form good roadbeds, absorb septic tank effluent or react to other uses. They are expressed as slight, moderate, severe and very severe as defined below:

Slight: The soil is well adapted for the use and has few if any limitations, restrictions or hazards that would interfere with the proposed use.

Moderate: The soil has moderate limitations, restrictions or hazards for the proposed use, but these can be easily corrected.

Severe: The soil has serious limitations, restrictions or hazards for the proposed use and requires intensive corrective management if it is to be so used.

Very Severe: These soils cannot support the proposed use. The physical nature of the soil must be completely altered or the soil material removed and replaced by more suitable materials.

These interpretations indicate the limitations of the soil for the proposed use and point up the kind and intensity of treatment needed to overcome these shortcomings.

Interpretations for non-agricultural uses are based on information coordinated for the southern states by the Soil Conservation Service under the provisions of Advisory Notice W-226 dated April 29, 1963. They deal with the limitations, restrictions or hazards of soils, imposed by their inherent physical characteristics for selected non-agricultural uses. The criteria for evaluating these physical properties are contained in several official in-service memoranda, the most important of which are Soils Memoranda No. 9, 21, 34, 37, 45 and 69.

Table E-2 shows the significant soils of the Basin and their ratings for six non-agricultural uses.

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TABLE E-2. - Degree of Limitations, Restrictions or Hazards of Principal Soils in St. Johns River Basin For Selected Uses1/

Principal Soils	Residential Developments	Septic Tanks	Sanitary Landfills	Highways	Graded Roads	Recreation Areas
St. Lucie	Moderate(s)2/	Slight	Slight	Moderate(s)	Severe(s)	Severe(s)
Paola	Moderate(s)	Slight	Slight	Slight	Severe(s)	Severe(s)
Lake) Astatula) Lakeland)	Slight	Slight	Slight	Slight	Moderate(s)	Moderate(s)
Palm Beach	Slight	Slight	Slight	Slight	Moderate(s)	Moderate(s)
Jonesville	Slight	Slight	Moderate(s)	Moderate(s)	Moderate(s)	Moderate(s)
Chiefland	Slight	Moderate(s)	Severe(s)	Slight	Moderate(s)	Moderate(s)
Arredondo) Gainesville)	Slight	Slight	Slight	Slight	Slight	Slight
Hague) Zuber)	Slight	Slight	Slight	Moderate(s)	Moderate(s)	Moderate(s)
Vaucluse	Slight	Moderate(s)	Slight	Slight	Moderate(s)	Moderate(s)
Archer) Stilson)	Moderate(s)	Severe(s)	Moderate(s)	Moderate(s)	Moderate(s)	Moderate(s)
Blanton) Kanapaha) Chipley) Orlando)	Slight	Moderate(w)	Moderate(w)	Slight	Moderate(s)	Moderate(s)
Hernando	Moderate(s)	Severe(s)	Severe(s)	Moderate(s)	Moderate(s)	Moderate(s)
Pomello	Slight	Moderate(w)3/	Moderate(w)	Moderate(s)	Severe(s)	Severe(s)

TABLE E-2. - (Continued)

Principal Soils	Residential Developments	Septic Tanks	Sanitary Landfills	Highways	Graded Roads	Recreation Areas
Adamsville						
Blichton						
Bradenton						
Broward						
Immokalee						
Keri						
Leon						
Mascotte	Moderate(w)	Severe(w)	Severe(w)	Moderate(w)	Moderate(w)	Moderate(w)
Myakka						
Ona						
Parkwood						
St. Johns						
Scranton						
Sunniland						
Arzell						
Basinger						
Bayboro						
Bladen						
Charlotte						
Copeland						
Coxville						
Delray						
Felda	Severe(w)	Severe(w)	Severe(w)	Severe(w)	Severe(w)	Severe(w)
Iberia						
Manatee						
Meggett						
Osier						
Plummer						
Pompano						
Portsmouth						
Placid						
Rains						
Rutlege						

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TABLE E-2. - (Continued)

Principal Soils	Residential Developments	Septic Tanks	Sanitary Landfills	Highways	Graded Roads	Recreation Areas
Brighton Everglades Istokpoga Pamlico Swamp Terra Ceia Salt marsh Coastal beach	Very Severe(w)	Very Severe(w)	Very Severe(w)	Very Severe(w)	Very Severe(w)	Very Severe(w)
Coastal dunes	Severe(s)	Moderate(s)	Severe(s)	Moderate(s)	Severe(s)	Severe(s)
Fellowship	Severe(s)	Severe(s)	Severe(s)	Severe(s)	Severe(s)	Severe(s)
Cocoa	Slight	Severe(s)	Severe(s)	Slight	Slight	Slight

1/ Definitions and significant soil properties used in making these ratings are given following this table.

2/ (s) Indicates inherent soil properties are principal limiting features.

3/ (w) Indicates excess water in or on the soil is principal limiting feature.

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Residential Developments

The interpretations of soils for residential use take into account the soil properties that affect footings and foundations for houses and other lightweight buildings of one or two stories, such as schools, stores, churches and the like. They also give consideration to soil properties that affect growth of plants used for landscaping and those that affect trafficability of the streets. Wetness, available water capacity, fertility, weight bearing ability, the need for and difficulty of land grading, and flood hazard, are important soil properties considered.

Septic Tanks

Septic tanks provide a suitable means of sewage disposal for low density housing when they can be placed in soils with good absorptive capacity. Success or failure of septic tanks depends primarily on the permeability of surface layers and on freedom of the soil from water saturated layers near the surface.

Sanitary Landfills

Sanitary landfills are a means of garbage disposal in places where suitable soils are readily available. To function properly, they should be placed on soils that permit rapid decomposition of garbage under well drained conditions. The properties that adversely affect soils for sanitary landfill are generally the same as those for septic tanks.

Highways

The interpretations of soils for highway use includes those for airport runways, large paved parking areas and similar uses that require reworking. The soils are considered in terms of the properties they display that affect grading and reworking. The interpretations are based on soil texture, shrink-swell values, slope and depth to rock.

Graded Roads

These include farm roads, unpaved streets and unpaved parking areas that support light vehicular traffic. Soil trafficability, the ease with which light vehicles can move over the surface of the soil, is the primary consideration for these interpretations. Trafficability is related to soil texture, consistence, compactability and wetness. Flood hazard, slope, erodability and depth to rock are other considerations.

Recreation Areas

Many out-of-doors recreation activities are affected by the soil. The activities considered in these interpretations are those that require relatively small areas. This includes such uses as camp sites for accomodating camping trailers and tents; picnic areas and playgrounds. These uses are affected by very much the same soil properties that affect graded roads, since unpaved access roads and unpaved parking areas are most significant to these uses. Trafficability, flood hazard, wetness and slope are usually the controlling factors.

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LEGEND

GENERAL SOILS MAPS
(Figures E-1 through E-19)

I. AREAS DOMINATED BY SOILS THAT NORMALLY DO NOT HAVE GROUND WATER WITHIN 60 INCHES OF THE SURFACE

A. WITH SANDY SURFACE LAYERS MORE THAN 40 INCHES THICK

1. Low ridges of strongly acid, nearly white, excessively drained sandy soils with minor areas of less well drained deep, nearly white sands.

2. Low narrow ridges and dunes of slightly acid, excessively drained shelly, sandy soils including areas of coastal beach, small mangrove swamps and small areas of made land.

3. Broad ridges of deep strongly acid yellowish sandy soils; small poorly drained depressions and small areas that have loamy materials less than 40 inches below the surface.

4. Broad ridges of deep slightly acid yellowish sandy soils; and small areas that have solid limestone or finer textured horizons within 40 inches of the surface.

5. Broad low ridges of medium acid brownish sandy soils; and small areas where finer textured subsoils are less than 40 inches deep.

B. WITH SANDY SURFACE LAYERS LESS THAN 40 INCHES THICK

6. Not represented in the Basin.

7. Not represented in the Basin.

8. Broad, low hills of slightly acid, brownish soils that have loamy or clayey subsoils, with high base saturation and well drained soils that are deeper than 40 inches to finer textured subsoils.

9. Broad well drained uplands that have soils with yellowish sandy surface layers over slightly acid clayey subsoils; and well drained soils that are deeper than 40 inches to finer textured subsoils.

10. Not represented in the Basin.

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II. AREAS DOMINATED BY NEARLY LEVEL SOILS IN WHICH THE GROUND WATER NORMALLY FLUCTUATES 30 TO 60 INCHES BELOW THE SURFACE

A. WITH SANDY SURFACE LAYERS MORE THAN 40 INCHES THICK

11. Low knolls and ridges of strongly acid, nearly white sandy soils; with small areas of well drained nearly white sands and poorly drained, very strongly acid gray sands that have an organic stained pan below the surface soils.

12a. Broad, low ridges of strongly acid, gray sandy soils; with areas of more poorly drained, very strongly acid gray sands that have an organic stained pan, and small swamps.

12b. Broad, low ridges of medium acid, gray sandy soils; with depressions of more poorly drained darker colored sandy soils, and similar soils that have fine textured subsoils less than 40 inches deep.

B. WITH SANDY SURFACE LAYERS LESS THAN 40 INCHES THICK

17a. Broad, low ridges of gray sandy soils which have mottled, slowly permeable strongly acid, loamy or clayey subsoils; and more poorly drained soils that have an organic stained pan.

16. Broad, low ridges of gray sandy soils which have strongly acid, slowly permeable loamy subsoils with high base saturation; and small areas of soils that have plastic clayey subsoils and small areas of soils with sandy surface layers more than 40 inches thick.

III. AREAS DOMINATED BY NEARLY LEVEL SOILS WITH GROUND WATER TABLE THAT NORMALLY FLUCTUATES 0 TO 30 INCHES BELOW THE SURFACE

A. WITH SANDY SURFACE LAYERS MORE THAN 40 INCHES THICK

13a. Broad, lowlands with very strongly acid gray sandy soils that have a brown organic stained pan within 30 inches of the surface; and areas of very poorly drained, very strongly acid deep sands.

13b. Broad lowlands with strongly acid gray sandy soils that have a brown organic stained pan within 30 inches of the surface; and areas of very poorly drained slightly acid or neutral deep sands.

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13c. Broad lowlands with very strongly acid gray sandy soils that have a brown, organic stained pan within 30 inches of the surface; with areas of very poorly drained, very strongly acid sands and knolls or ridges of better drained nearly white sands.

13d. Broad lowlands with very strongly acid gray sandy soils that have a brown, organic stained pan within 30 inches of the surface, and areas of very poorly drained, very strongly acid sands, and knolls or ridges of better drained strongly acid deep, gray sandy soils.

14. Broad lowlands of strongly acid, deep sandy soils that have thick, black surface layers; and small areas of very poorly drained soils in depressions.

15. Broad lowlands of slightly acid deep sandy soils; and very poorly drained, slightly acid deep sandy soils in depressions.

B. WITH SANDY SURFACE LAYERS LESS THAN 40 INCHES THICK

18a. Broad lowlands with soils that have gray sandy surface layers and slightly acid to mildly alkaline mottled, loamy subsoils; and areas of very strongly acid soils that have an organic stained pan between the sandy surface layers and loamy subsoil, and lower, very poorly drained sandy soils.

18b. Broad lowlands with soils that have gray sandy surface layers and neutral, mottled clayey subsoils; and very strongly acid soils that have an organic stained pan between the surface soil and subsoil, and very poorly drained, slightly alkaline sandy soils with loamy subsoils.

18c. Lowlands with soils that have gray sandy surface layers and thin, neutral to alkaline loamy subsoils over marl; and soils that have thicker loamy subsoils, and small areas of lower, wetter soils.

18d. Lowlands that have soils with thick, very dark gray to black sandy surface layers and neutral loamy or clayey subsoils; and soils that are more poorly drained with thick black surface layers, and soils that have sandy surface layers more than 40 inches thick.

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19. Broad lowlands that have soils with thin gray surface layers and highly mottled, slowly permeable acid clayey subsoils; and small areas of more poorly drained soils with very dark gray or black surface layers, and strongly acid, mottled clayey subsoils.

19a. Broad lowlands that have soils with thin gray surface layers and highly mottled, slowly permeable acid clayey subsoils; and small areas of soils that are underlain at shallow depths by marly materials.

21. Broad lowlands that have soils with thin sandy surface layers over hard limestone; and soils which have loamy subsoil layers between the surface layers and limestone.

IV. AREAS DOMINATED BY NEARLY LEVEL SOILS IN WHICH THE GROUND WATER NORMALLY IS WITHIN 15 INCHES OF THE SURFACE AND FREQUENTLY RISES A FEW INCHES ABOVE THE SURFACE

A. WITH SURFACE LAYERS MORE THAN 40 INCHES THICK

22. Low, wet flatlands that have soils with thick very strongly acid, light gray to black sandy surface layers; and small knolls and ridges of soils that have thick, strongly acid sandy surface layers over organic stained pans.

23. Low, wet flatlands that have soils with thick, slightly acid to neutral light gray to black sandy surface layers; and small knolls and ridges of soils that have thick, strongly acid sandy surface layers over organic stained pans.

B. WITH SANDY SURFACE LAYERS LESS THAN 40 INCHES THICK

24a. Low, wet flatlands that have soils with dark gray to black sandy or mucky surface layers over slightly acid to mildly alkaline loamy or clayey subsoils; and small areas of soils that have sandy layers to more than 40 inches deep.

24b. Low, wet flatlands that have soils with dark gray to black sandy or mucky surface layers over strongly acid clayey subsoils; and small areas of soils that have sandy layers to more than 40 inches deep.

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24c. Low, wet flatlands that have soils with light gray surface layers over slightly acid to neutral loamy or clayey subsoils; and small knolls and ridges of better drained sandy soils that have an organic stained pan between the surface and loamy subsurface layers.

25. Low, wet flatlands with soils that have thin sandy or marly surface layers over limestone.

C. WITH THICK ORGANIC SURFACE LAYERS

26. Low, nearly level marshlands and swamps that have organic accumulations more than 20 inches thick.

MISCELLANEOUS LAND AREAS

27. Low, wet swampy areas subject to frequent and prolonged flooding.

28. Low, wet swamplands and marshes subject to frequent flooding by salt water.

29. Mine pits and dumps.

30. Urban areas and made land.

MAJOR LAND RESOURCE AREAS

LEGEND*

138 North Central Florida Ridge

153 Atlantic Coast Flatwoods

154 South Central Florida Ridge

155 Southern Florida Flatwoods

156 Everglades and Associated Areas

*Major Land Resource Areas as identified in "Land Resource Regions and Major Land Areas of the United States", Agriculture Handbook 296, USDA-SCS, December 1965.

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Figure E-1

GENERAL SOIL MAP
ALACHUA COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

Original map at 1:126,720 on Lambert Conformal Conic Projection has been reduced without regard to scale to fit standard 8 x 10½'' format.

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May 1967

4-R-24099

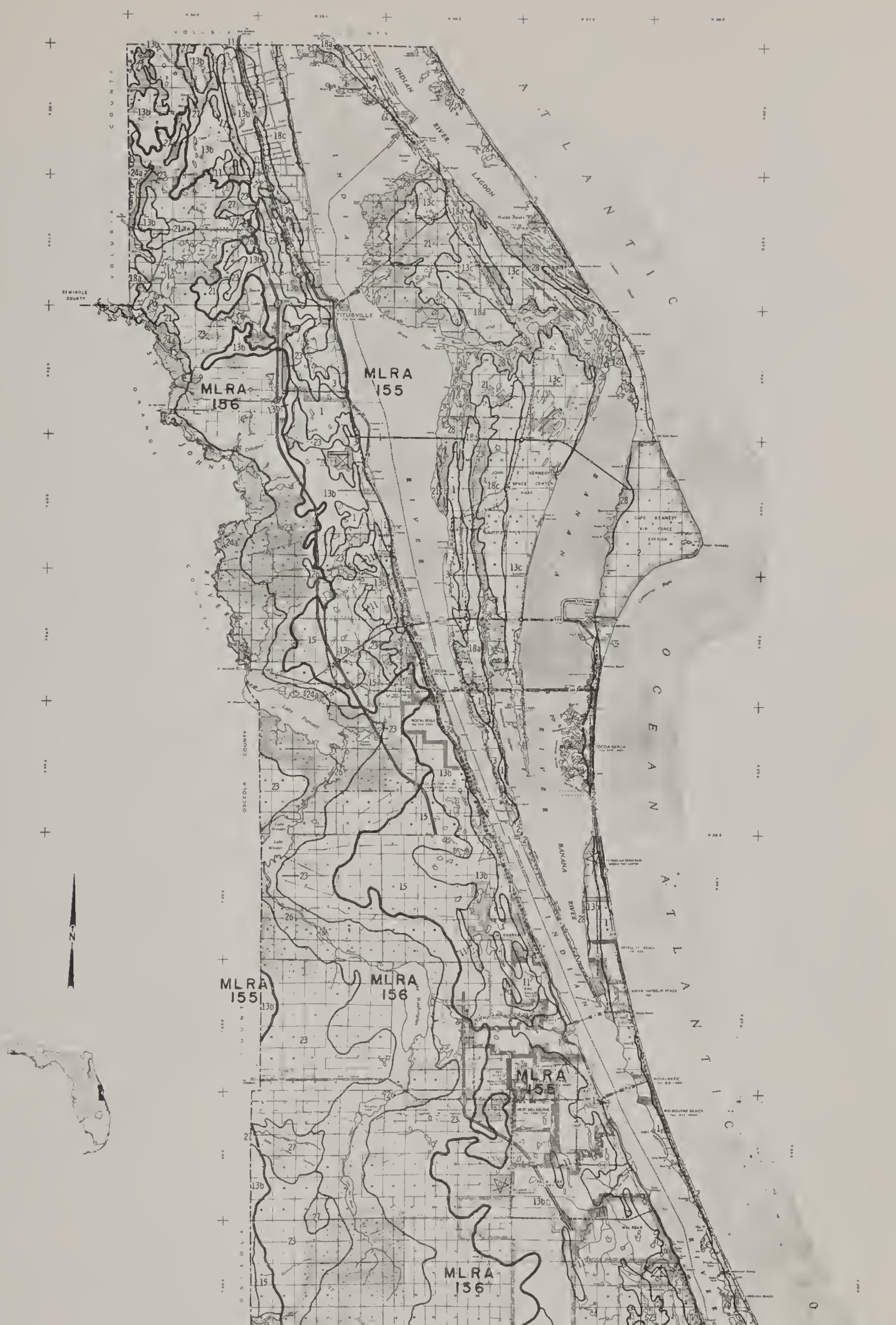

Figure E-2

GENERAL SOIL MAP

BREVARD COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

GAINESVILLE, FLORIDA

IN COOPERATION WITH

UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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July 1967

4-R-24101

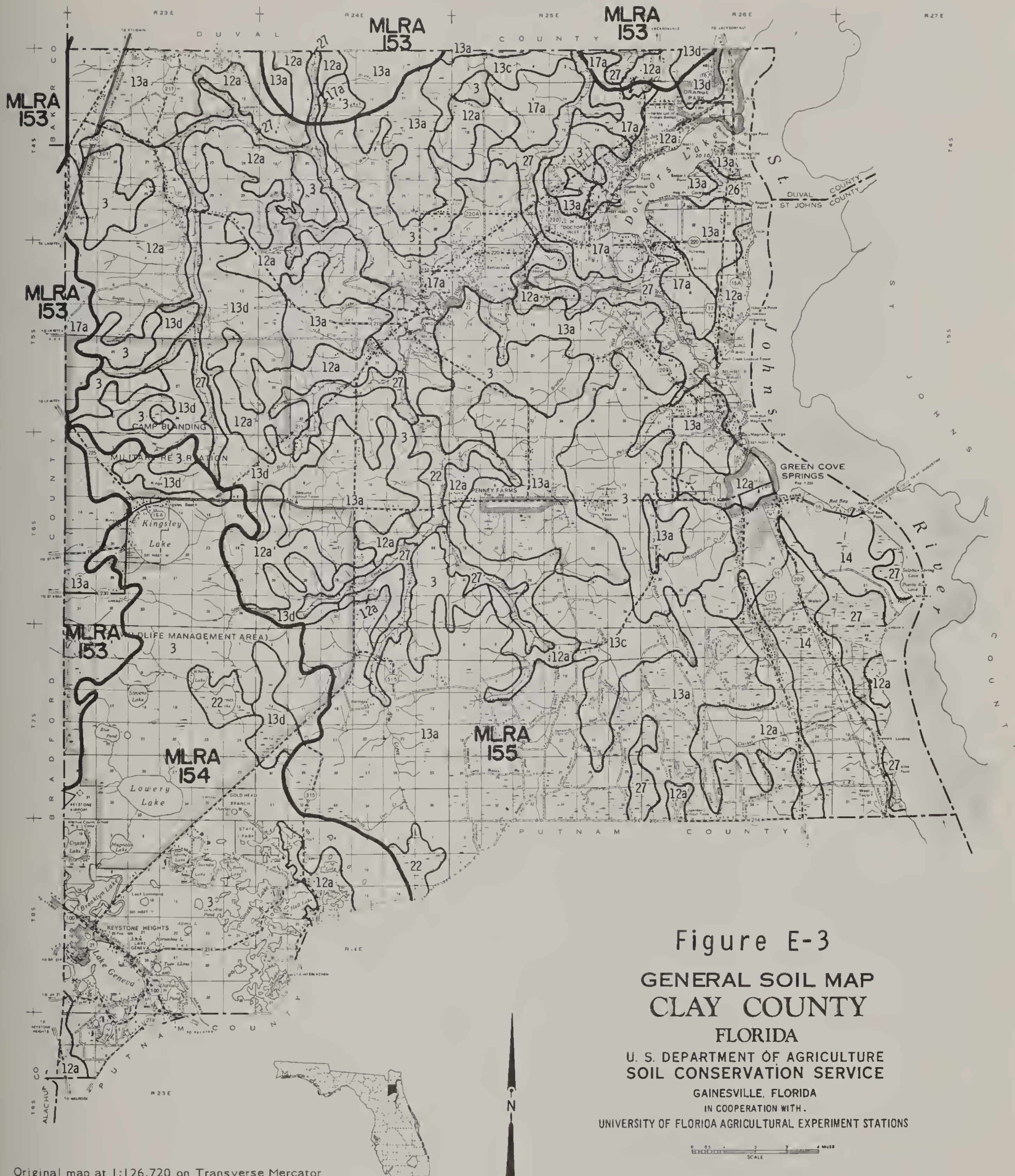

Figure E-3

GENERAL SOIL MAP
CLAY COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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May 1967 4-R-23871

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Figure E-4

GENERAL SOIL MAP
DUVAL COUNTY
FLORIDA

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SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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May 1967

4-R-23868

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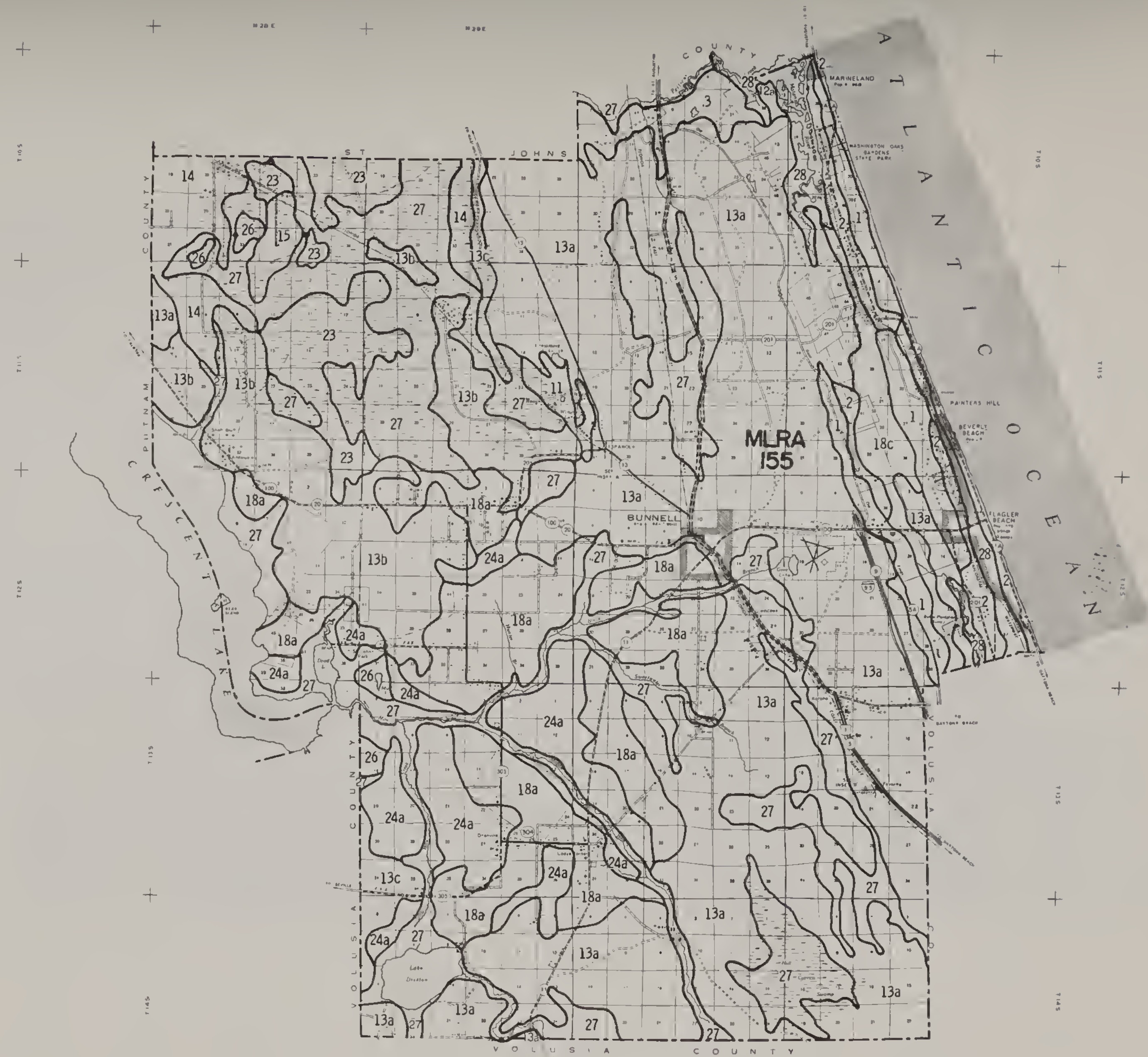

Figure E-5

GENERAL SOIL MAP

FLAGLER COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA

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April 1967

4-R-23872

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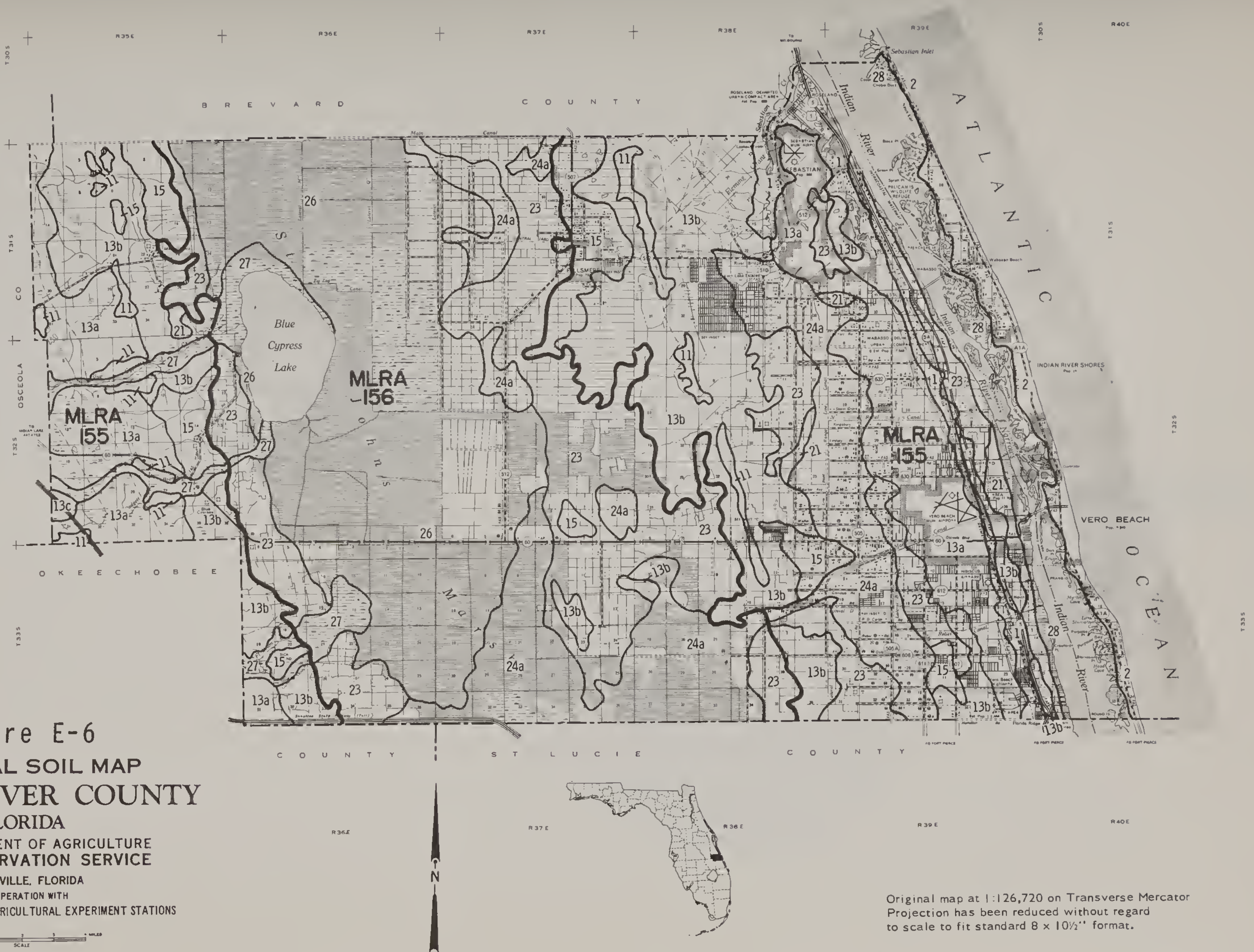

Figure E-6

GENERAL SOIL MAP

INDIAN RIVER COUNTY

FLORIDA

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SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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May 1967

4-R-24248

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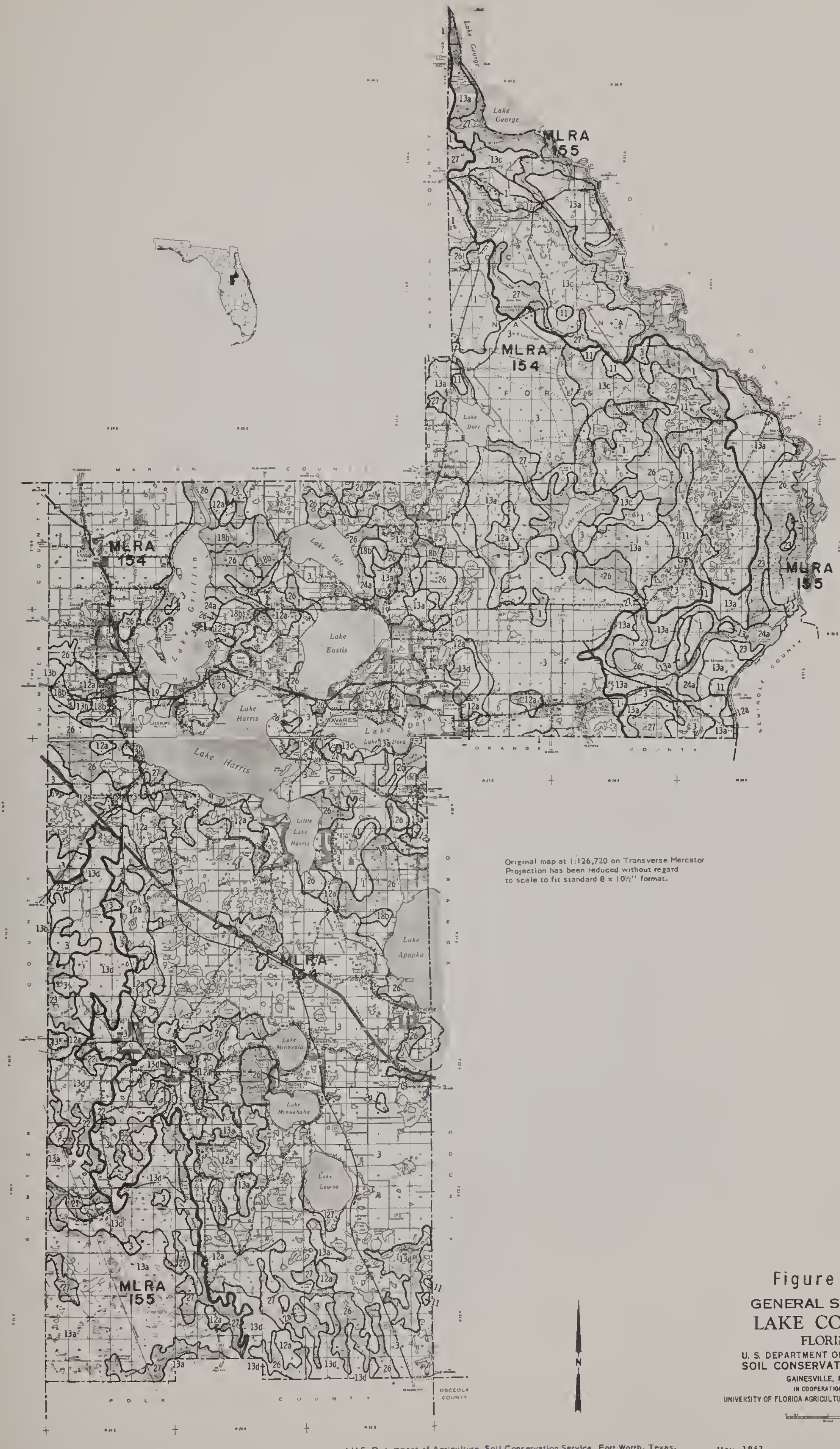

Figure E-7

GENERAL SOIL MAP

LAKE COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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USDA-SCS FORT WORTH TEX 1969

May 1967

4-R-24252

Figure E-8

GENERAL SOIL MAP

LEVY COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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Figure E-9

GENERAL SOIL MAP
MARION COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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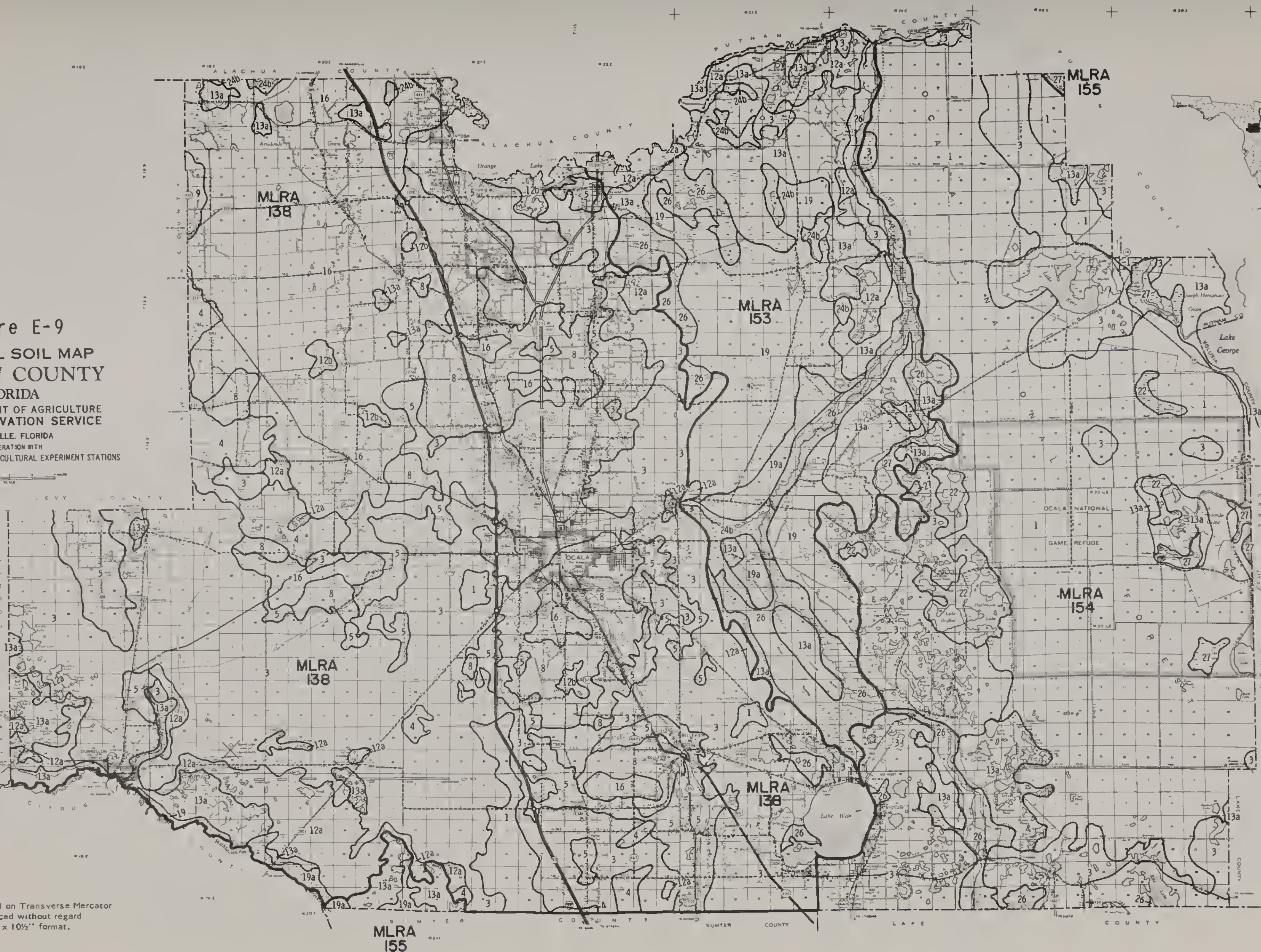
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS



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May 1967

4-R-24251

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Figure E-10

GENERAL SOIL MAP
OKEECHOBEE COUNTY
FLORIDA

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GAINESVILLE, FLORIDA
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May 1967

4-R-24249

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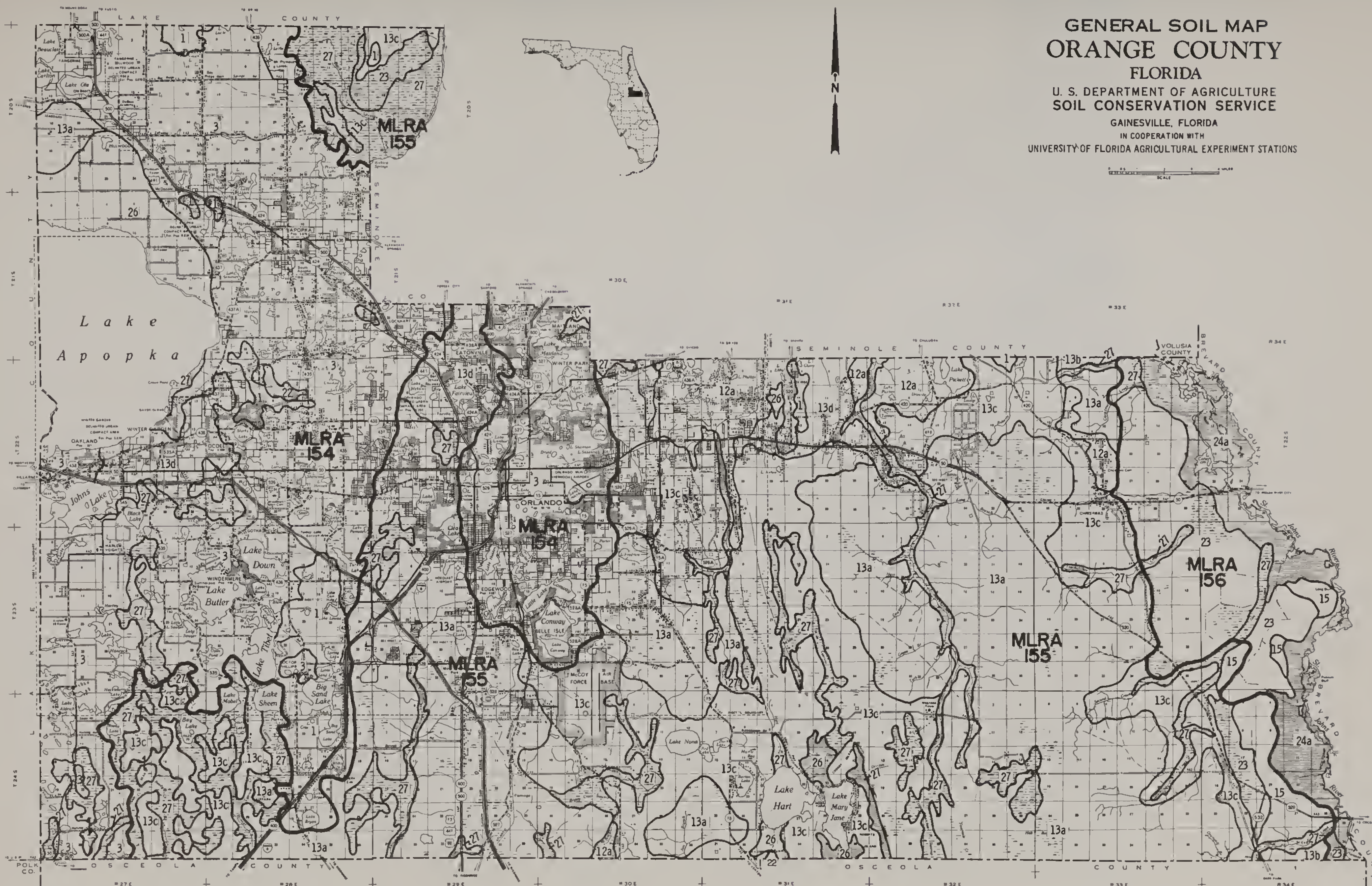
Figure E-11

GENERAL SOIL MAP
ORANGE COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS



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May 1967

4-R-24103

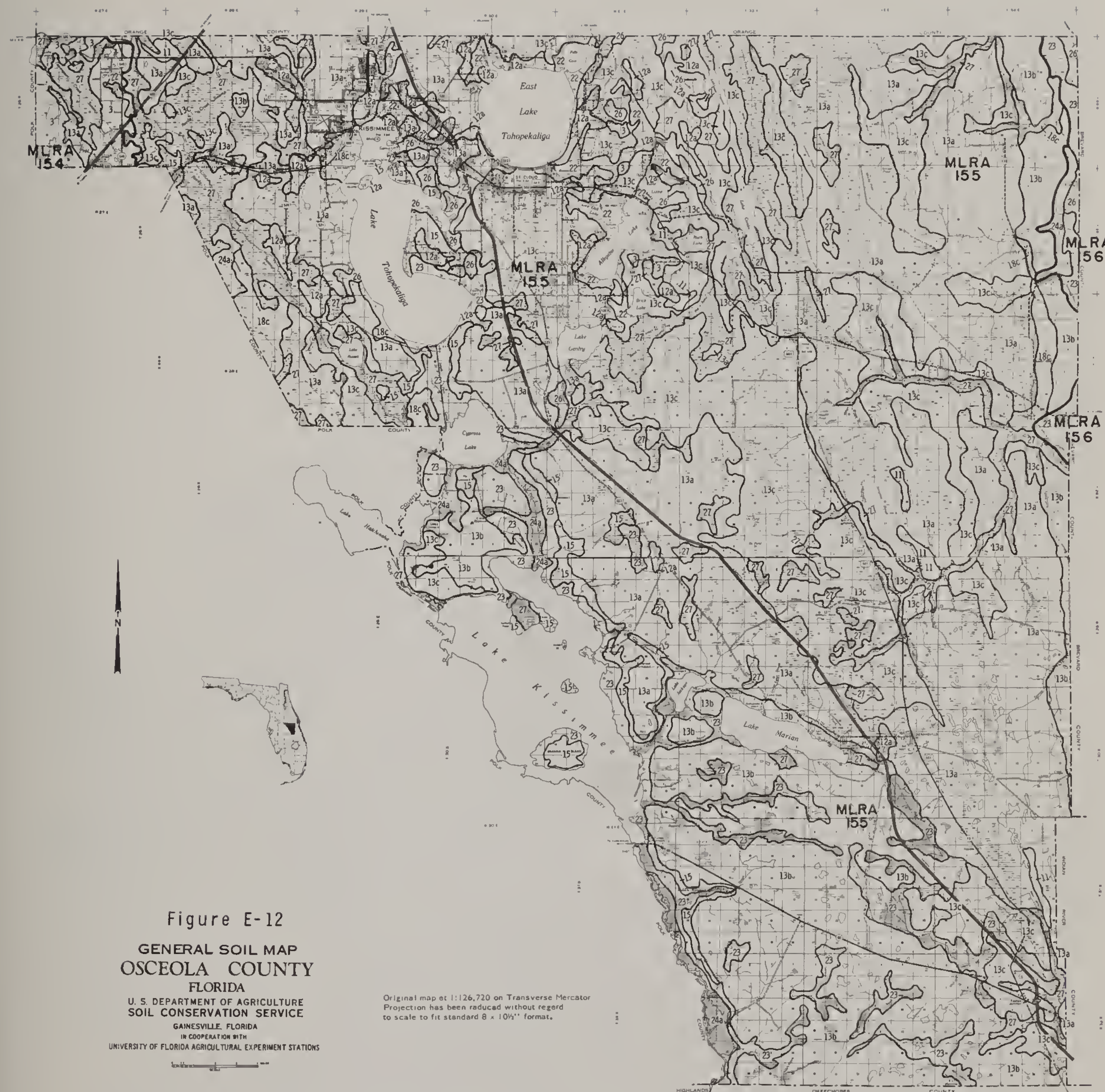

Figure E-12

GENERAL SOIL MAP
OSCEOLA COUNTY
FLORIDA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

Figure E-13
GENERAL SOIL MAP
POLK COUNTY
FLORIDA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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USDA SCS FORT WORTH TEX 1969

May 1967

4-R-24253

Figure E-14

GENERAL SOIL MAP

PUTNAM COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

GAINESVILLE, FLORIDA

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UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

May 1967

4-R-23870

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USDA SCS-FORT WORTH, TEX 1968

Figure E-15

GENERAL SOIL MAP

SEMINOLE COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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May 1967

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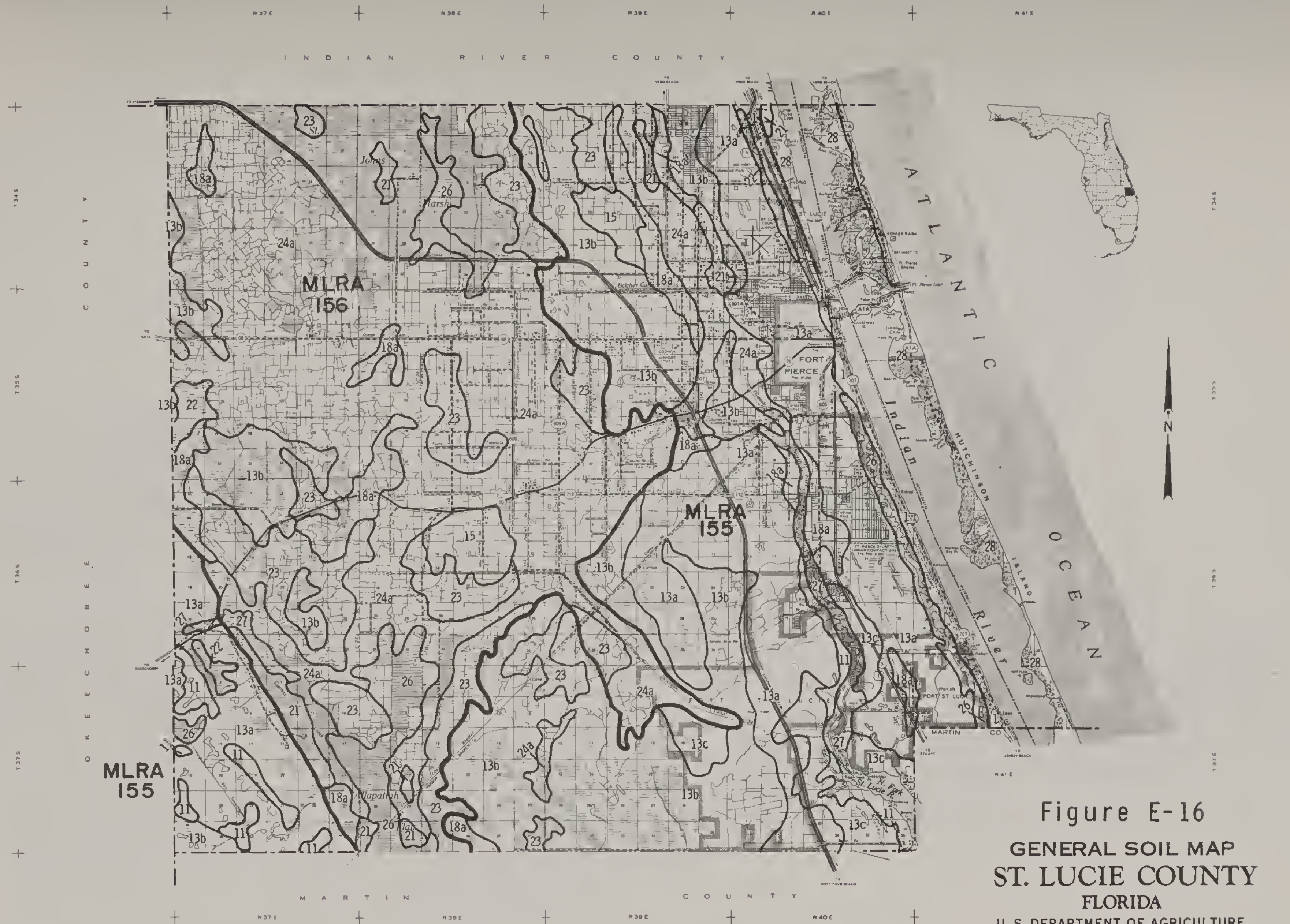

Figure E-16

GENERAL SOIL MAP
ST. LUCIE COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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May 1967

4-R-24240

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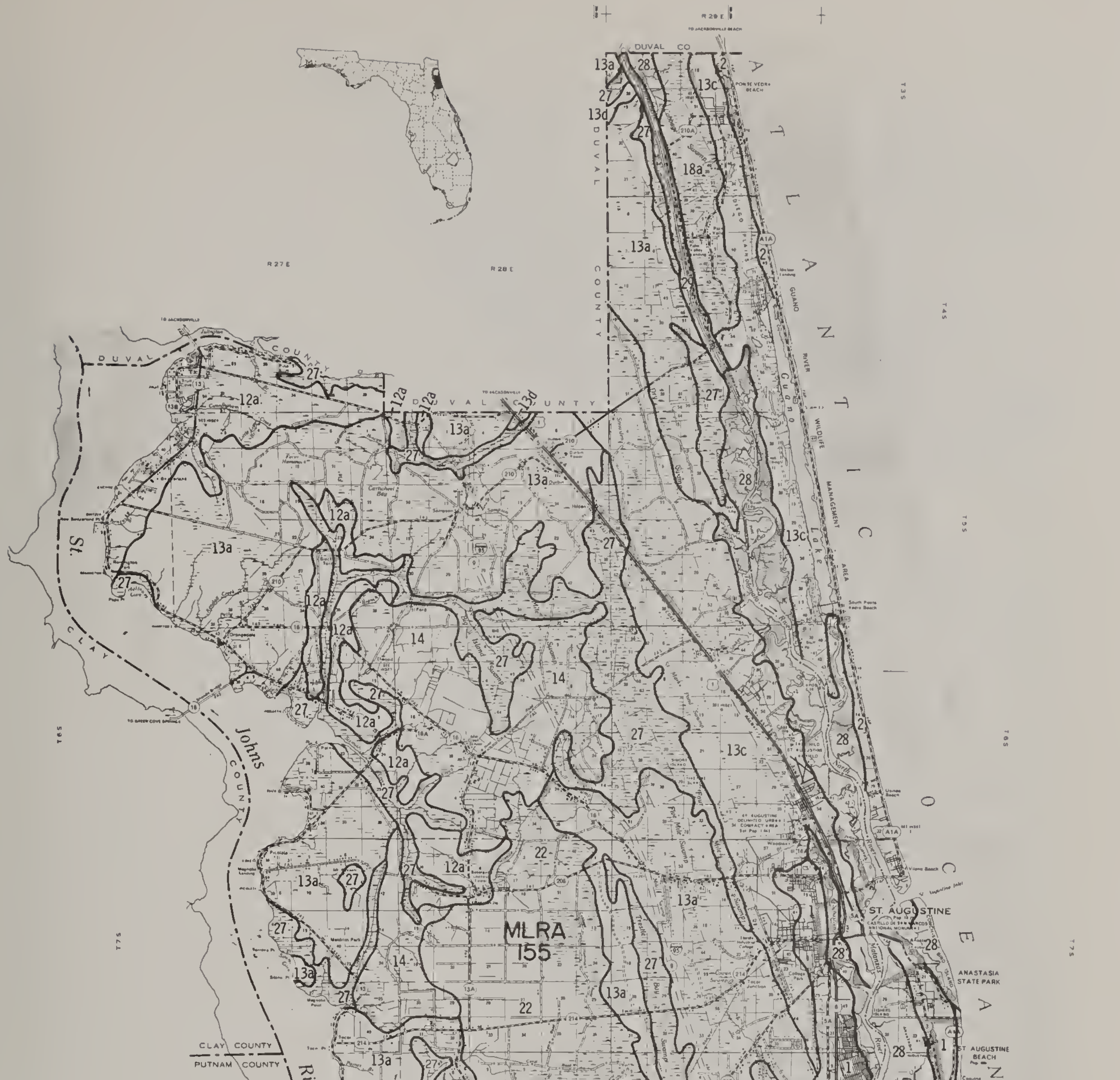

Figure E-17

GENERAL SOIL MAP

ST. JOHNS COUNTY

FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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April 1967

4-R-23873

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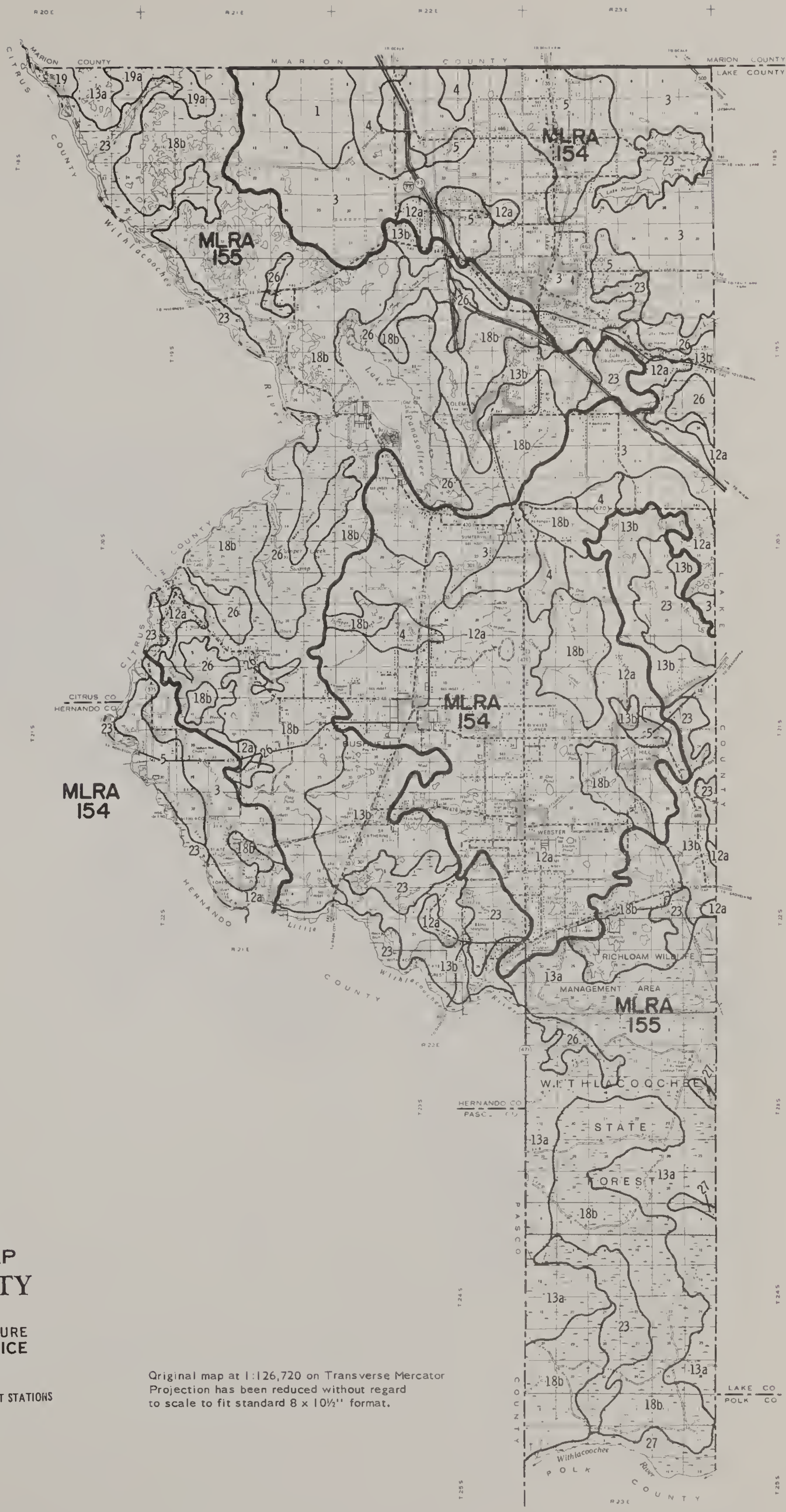

Original map at 1:126,720 on Transverse Mercator Projection has been reduced without regard to scale to fit standard 8 x 10½" format.

Figure E-18
GENERAL SOIL MAP
SUMTER COUNTY
FLORIDA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
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May 1967

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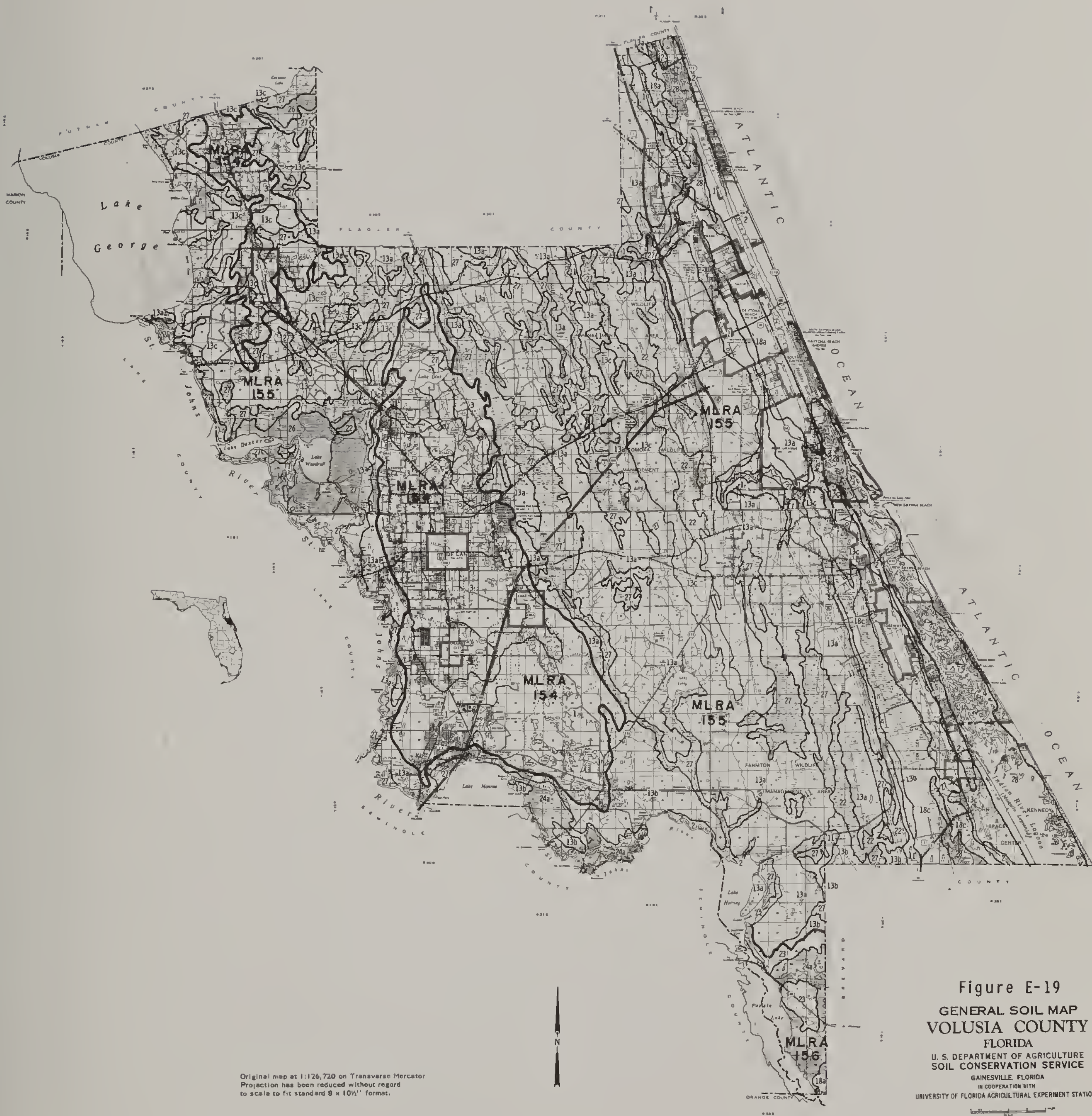

Figure E-19

GENERAL SOIL MAP
VOLUSIA COUNTY
FLORIDA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GAINESVILLE, FLORIDA
IN COOPERATION WITH
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

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Projection has been reduced without regard
to scale to fit standard 8 x 10½'' format.

May 1967 4-R-23869

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